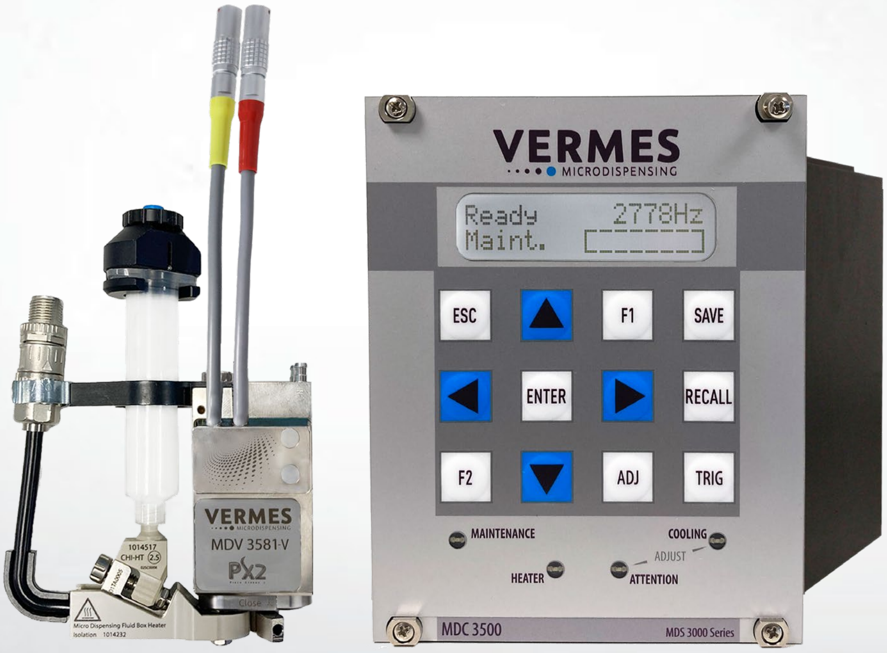
precision dots

VERMES
MICRODISPENSING

USER MANUAL

29.07.2025 Rev. 1

Microdispensing System
MDS 3581-V



Microdispensing Systems with PX2 Technology

www.vermes.com

User Manual for Microdispensing Systems of the MDS 3581-V

System	Control Unit	Valve
MDS 3581-V	MDC 3500-V	MDV 3581-V

Tab. 1: Available products

1 Introduction

With a micro dispensing system of the MDS line from VERMES Microdispensing, you have bought a high quality product. Due to the longstanding experience of the team in regards to electronic devices and piezo controls, these products provide highest functionality and reliability.

Thank you very much for your trust in us.

We will now show you how to assemble and use the microdispensing system. In order not to impair the inherent safety concept of the system, you have to follow the procedures described in this manual consequently during installation and operation.

Read this manual before you start the assembly and always consult it during the use of the microdispensing system.

Start with the chapter “Safety Notes” (see chapter 2, page 8). This will help to prevent any problems for the user or the equipment. In the case of further questions, consult our Technical Support.

Technical Support	**VERMES Microdispensing GmbH** Rudolf-Diesel-Ring 2 83607 Holzkirchen Tel.: +49 (0) 80 24 6 44-26 Fax.: +49 (0) 80 24 6 44-19 support@vermes.com www.vermes.com

Service hours Monday - Friday 9.00 to 17.00 (CET). We recommend checking the relevant serial numbers (e.g. MDC and MDV) and the firmware revision before contacting the support.

The MDS 3000 Product Family

The MDS models are members of the MDS 3000 product family, specialized in most accurate dispensing and designed for flexible use with substances of medium and high viscosity (up to 2000000 mPas). Applications can be found in the fields of SMT and in the production of electronics, semiconductors and photovoltaic modules and many more.

Each microdispensing system belonging to the MDS 3000 product family is composed of a high precision valve based on a piezoelectric element (MDV series), a control unit (MDC series) and an optional selectable supply unit.

Due to its compact modular design, the system can be integrated quickly into any existing production environment without major preparatory work. A change in the production line (e.g. a modification of the liquid to be processed) is easily possible, since all of the dispensing parameters are adjustable in a large range. Finetuning of the sequence is therefore possible at any time. The system allows for reproducible proportioning of hundreds of identical single dots or beads within a few seconds.

A comprehensive choice of accessories is available, e.g. nozzle inserts, tappets, seals and supply units, so that the system can easily be adapted to new challenges any time, without giving rise to major investment.

2 Safety Notes

This chapter summarizes the general safety aspects of the system. Further points to observe are emphasized in the corresponding subchapters.

2.1 Obligations and Liability

In order to protect the health of personnel and to avoid unnecessary damage, all of the recommendations of the manufacturer concerning safety must be explained to every member of the team taking part in installation, operation or maintenance of the system.

VERMES Microdispensing does not accept any liability for material damages or personal injury originating from inappropriate use, violation of safety prescriptions, or any procedure inconsistent with the instructions of this manual. The general rules for prevention of accidents as well as local environmental regulations must be in place and thoroughly followed by the personnel.

2.1.1 Obligations of the Customer

In view of a trouble-free operation of the microdispensing system, the customer has to select his personnel carefully:

- Unauthorized use must be prevented. Persons ignoring the fundamental requirements of industrial safety, environmental protection and prevention of accidents are not allowed to work with the system.
- New operators must correspondingly be instructed and trained, so that they can understand and put into practice the instructions of this manual. For certain measures, a particular qualification may be required.
- The manual must remain accessible at any time.

2.1.2 Obligations of the Operator

All persons in charge of the system must:

- Continuously respect the general rules for prevention of accidents.
- Be aware of the safety notes of this manual. This is necessary also for operators trained by the manufacturer or experienced in work with similar systems.
- Consult the manufacturer in any case of doubt. Applications beyond the scope of the specification and improvised repair work must be avoided.

2.2 Residual Risks

The microdispensing system has been developed and designed with the common requirements of safety in mind, and corresponds to the current state of technology. In the delivered layout, it complies with the following regulations and directives:

- 2014/30/EU Electromagnetic Compatibility
- 2011/65/EU Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS 2013-01-03)
- DIN EN 61010-1 (VDE 0411) Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory
- DIN EN ISO 12100-1 and DIN EN ISO 12100-2 Safety of the Machinery, Fundamental Terms
- DIN EN 60204-1 (VDE 0113) Safety of the Machinery, Electric Installations of Machinery, Part 1 General Requirements
- DIN EN 982 Safety Requirements for Fluid Power Systems and their Components – Hydraulics

Despite this comprehensive inherent safety structure, the operation of the microdispensing system may entail danger

- For the health of the operator or a third party,
- For the system itself,
- Or give rise to another material damage.

Therefore, the use has strictly to be limited:

- To the intended application.
- To a state in which the technical safety of the system can be guaranteed (i.e. it is strictly forbidden to start or continue the operation whenever a defect has become obvious).

You have to solve problems immediately, if they have a potential to impair safety aspects. For this reason, it is imperative that this manual remains accessible any time without delay. In an emergency, a short reaction time may be crucial.

If you transmit the system to any other department or institution, this manual must accompany it.

2.3 Contracted Use

The systems of the MDS 358x Series have been designed for ultra-precise contactless dispensing of fluids in a large range of viscosity (up to 2000000 mPas), in unfilled or filled state (also with abrasive extenders), to be operated in a conveniently equipped industrial or laboratory environment.

Deviations from the instructions of this manual must explicitly be authorized by the manufacturer (in writing); otherwise his liability with regard to the guarantee becomes null and void.

This includes:

- Extensions and changes of design
- Modifications of the system, or spare parts not recommended by the manufacturer
- Inappropriate material selection (lack of compatibility between parts and dispensed fluids)
- Operation with damaged parts or after improvised repair
- Dispensing of fluids able to affect the functionality of the system (in case of doubt, consult manufacturer)
- Manipulation or absence of integrated safety devices or sealings
- Repair by persons or enterprises not authorized by the manufacturer
- Operation beyond the scope of the specification
- Auxiliary equipment not recommended by the manufacturer
- The system is not admitted for applications in hazardous locations (ATEX zones)

In no event shall we be liable under our guarantee or any other provision of the agreement for damages resulting from a violation of the instructions of this manual.

For further questions concerning current applications and modifications of the system with respect to new requirements, contact the manufacturer, the responsible sales partner or the Technical Support.

2.4 Specification and Technical Notes

- The system is designed for interior use only. Maximum altitude: 2000 m.
- The relative air humidity shall not surpass 80 % rH at 31 °C or 50 % rH at 50 °C (with a linear decline).
- Temperature: 10 °C till 50 °C
- Admissible mains voltage fluctuations: Within the range of ± 10 % of rated voltage.
- Transient overvoltage tolerated acc. to IEC 60364-4-443, max. degree of soiling: 2
- Mains cables must feature a protective conductor. In the case of cables not delivered by Vermes Microdispensing, the guarantee for the MDS is valid only up from the interface.
- Power outlets must comply with common safety prescriptions.
- During the application, you must guarantee sufficient air circulation. For further details, refer to Installation chapter (see paragraph 6.3.1 "Installation of the Control Unit", page 52).

  For exact dispensing results, the temperature of the actuator system should stay below 80 °C. Therefore, you might need cooling. Cooling is achieved by compressed air, free of fine particles, dust, oil and condensate, quality classes 3, 4, 3 acc. to DIN/ISO 8573-1:2010.

- Solid particles: Quality class 3

  max. number of particles/m^3: 0.5 – 1 µm: < 90000, 1 – 5 µm: < 1000

- Water content: Quality class 4

  max. pressure dew point +3 °C

- Residual oil: Quality class 3

  1 mg/m^3 max.

2.5 Warnings

- Handle the mains cables correctly: Always seize the cable at the plug. Never touch it with wet hands.
- Under no circumstances connect a schuko-plug (type F, CEE 7/4) with a socket build for an unearthed plug (type C, CEE 7/17). The system would not be grounded.
- The cable should never be squeezed or kinked. Never place the instrumentation (or any other object) on the cable.
- Damaged cables may give rise to fire and danger caused by electricity. Inspect them visually in regular intervals. You should exchange damaged parts at once.
- In the case of a major disturbance, disconnect the equipment immediately from the mains.
- Spare parts not delivered or recommended by the manufacturer could affect the inherent safety of the system. The same problem arises, if the customer attempts to process substances not admitted for the dispensing system.
- Unqualified repair work often causes major damages, sometimes even personal injuries. Therefore, repair is reserved to our Technical Support and authorized subcontractors.
- Before removing the actuator and sensor cable, the system must be switched OFF.
- For longer interruptions, switch OFF the control unit.
- Before disconnecting the control unit from the mains, switch it OFF.
- Repeatedly switching ON and OFF the equipment may reduce the lifetime of the power unit.
- Before charging the fluid system with an aggressive, reactive or toxic substance, you have to verify that it is compatible with all of the contacting components inside the system.
- The supply pressure at the cartridge or in the pressure tank of 7 bar resp. 100 bar (according to the system configuration) should never be exceeded.

- If you use the valve with a heater for the nozzle unit, the temperature in that area can reach up to 180 °C. Do not touch it during operations and afterwards only once it had enough time to cool down.
- When cleaning the components in contact with the transported substance, you should place the device in a safe and stable position, without being subjected to vibrations.
- To clean the actuator, a cloth not fluffy and lightly moistened (e.g. by Isopropanol) is recommended. During the cleaning procedure, no liquid should penetrate into the actuator itself (e.g. through the plug).
- The valve is designed according to the Normally Open principle. Therefore, the valve is normally open and the transported liquid can flow. Before switching OFF the microdispensing system, do not forget to lower the supply pressure to atmospheric pressure.

2.6 Qualifications of Operators and Maintenance Personnel

The microdispensing system together with all attached accessories should only be used by competent personnel with an adequate qualification. They must know and understand the content of the manual. We do suppose that the department head is aware of possible dangers, and correspondingly assigns the tasks to persons able to execute their work in a responsible manner.

According to DIN VDE 0105 and IEC 364 qualified personnel refers to members of the team with a sufficient knowledge of relevant norms, directives and rules for prevention of accidents. They need the qualification and experience necessary, so that they are in a position to realize and to prevent possible dangers already at an early stage. Knowledge in First Aid and a direct contact to the local emergency units is required as well.

2.7 Protective Equipment and Safety Clothing

You should always wear suitable protective equipment, whenever handling or dispensing aggressive, reactive or toxic substances. The same is valid in the presence of a high supply pressure.

Safety Clothing	Safety Icon
Safety glasses	
Breathing apparatus	
Overall and gloves resistant to the corresponding chemical fluid	
When you work in the direct vicinity of the MDS for a prolonged period, you should also wear ear protection.	

Tab. 2: Protective Equipment and Safety Clothing

3 General Instructions

This chapter summarizes the content of this manual and contains general information for the user. Some pictures might differ slightly from the actual product.

3.1 How to Use this Manual

- Each step of installation, operation and maintenance has to be performed in accordance with this manual.
- You can find information about safety aspects and an efficient use of the system in the concerning chapters.
- This manual represents an integral part of the delivery and must be made available to every user working with this system. Always keep it in close vicinity.
- It must be preserved until the end of the lifetime of the system.

3.2 Legend

3.2.1 Danger Levels

Instruction	Possible Consequences
DANGER!	The damage is imminent! If the operating procedure is not strictly observed, this situation may result in death, considerable material damage or environmental contamination.
WARNING!	Warn of a potentially dangerous situation! The danger of death and serious injuring cannot be excluded.
CAUTION!	Cautions about a potential problem! Danger of minor or medium injuries.
IMPORTANT NOTE!	Warns about potential damage to the equipment! An operating procedure which, if not strictly observed, may result in damage to the equipment, unexpected interruptions or shutdown.
INFORMATION!	Supplementary recommendation for an economical and timesaving use of the equipment.

Tab. 3: Danger levels

3.2.2 Illustration Convention

Symbol	Explanation
Step 1: **Step 2:**	The sequence must be followed in correct order
–	Each step of this sequence is mandatory, none of them should be omitted
➡	Direction of movement
•	Lists
[…]	Symbol for a key on the keypad

Tab. 4: Illustration convention

3.2.3 Abbreviations

Abbr.	Full Name
CTF	Ceramics Tappet Flat
CTK	Cleaning Tool Kit
MDC	Controller (MicroDispensingControl unit)
MDF	Fluid box (MicroDispensingFluid box)
MDS	MicroDispensingSystem
MDT	MicroDispensing Tool
MDV	Valve (MicroDispensingValve)
MDX	Supply unit
MFC	Multifunctional Controller
NFN	Nozzle Fixation Nut
NI	Nozzle Insert
PLC	Programmable Logic Controller
POD	Point of Dispensing
RTC	Real-time clock
TTF	Tungsten carbide Tappet Flat

Tab. 5: Abbreviations

3.3 Tools

The following tools are required to install and to operate the MDS:

- MDT 301 - Universal Tool (Order no. 1010208)
- MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)
- MDT 306 - Torque Wrench Tool VM black (Order no. 1015062)
- MDT 307 - Adjust Tool TA (Order no. 1014143)
- MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)
- MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no.1014283)
- MDT 324 - Nozzle Insert Cleaning Holder (Order no.1014310)
- MDT 327 - Multi-Function Tool (Order no.1014440)
- MDT 328 - Tappet Sealing Changing Tool (Order no.1014503)
- Hexagon Key Set (Order no. 1012993)

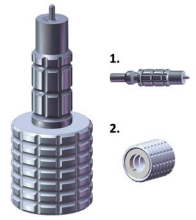
When you order tools, always specify the order number of the required item.

IMPORTANT NOTE

No foreign tools

Do not use auxiliary tools or foreign products, otherwise damages to the equipment might be possible.

3.3.1 MDT 301 - Universal Tool

The tool MDT 301 comprises two subcomponents screwed to each other: • "Sealmounter" with a mandrel to insert and to remove the tappet sealing (1.) • "Adjustment grip" with a receptacle for the adjust screw (2.)	
Intended Purpose: 1. Fixing of tappet sealing and tappet centering piece 2. It may also be used to execute the general adjust (alternatively to tool MDT 327)	

Tab. 6: MDT 301 - Universal Tool (Order no. 1010208)

3.3.2 MDT 303 - Nozzle Insert Changing Tool

The MDT 303 is required for the exchange of the nozzle insert. The 3 pins of the MDT 303 grip into the receptacle bores of the tappet centering screw in order to unscrew the tappet centering screw from the fluid box.	
Intended Purpose: 1. Screwing apart/together fluid box body and tappet centering screw	

Tab. 7: MDT 303 - Nozzle Insert Changing Tool (Order no. 1007083)

3.3.3 MDT 307 - Adjust Tool TA Hot Melt Handle

The MDT 307 can be used in combination with the bit BitVM-A Tightening Screw, magnetic (order no. 1014519) to perform the adjust with a valve capable of the top adjust function.	
Intended Purpose: 1. Performing the top adjust	

Tab. 8: MDT 307 - Adjust Tool TA Hot Melt Handle (Order no. 1014143)

3.3.4 MDT 316 - Nozzle Insert Cleaning Tool

<table>
<tr><td colspan="2">The MDT 316 is used to clean clogged nozzle inserts made of carbide metal, ceramics or diamond (series N11 to N22). This is achieved by pumping a fat or grease with high pressure through the nozzle channel. Additional information is in the Quick Reference Guide MDT 316 Nozzle Insert Cleaning Tool. You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).</td></tr>
<tr><td>**Intended Purpose:**
1. Cleaning of clogged nozzle inserts</td><td> </td></tr>
</table>

Tab. 9: MDT 316 - Nozzle Insert Cleaning Tool (Order no. 1013324)

3.3.5 MDT 323 - Nozzle Insert – Squeezing Out Tool TA

<table>
<tr><td colspan="2">The MDT 323 has a thin and a wide end. Both are meant for different applications.</td></tr>
<tr><td>**Intended Purpose:**
1. Detaching the nozzle insert from the fluid box (thin end)
2. Detaching the tappet sealing (wide end)</td><td> </td></tr>
</table>

Tab. 10: MDT 323 - Nozzle Insert – Squeezing Out Tool TA (Order no. 1014283)

3.3.6 MDT 324 - Nozzle Insert Cleaning Holder

<table>
<tr><td colspan="2">The MDT 324 has a receptacle, in which the nozzle insert is placed to be held tight. Then you can clean the nozzle insert with compressed air without the danger of blowing it away accidently. Additional information is in the Quick Reference Guide “Nozzle Insert Cleaning Holder MDT 324”. You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).</td></tr>
<tr><td>**Intended Purpose:**
1. For holding a nozzle insert during cleaning with compressed air</td><td>
</td></tr>
</table>

Tab. 11: MDT 324 - Nozzle Insert Cleaning Holder (Order no. 1014310)

3.3.7 MDT 327 - Multi-Function Tool

<table>
<tr><td colspan="2">The knobs of the MDT 327 grip into the slots of the adjust screw or into the slots of the tightening screw (gearing VM-A). The other end holds open-ended wrenches (size 7) and (size 8). They are needed for mounting the system.</td></tr>
<tr><td><b>Intended Purpose:</b>
1. Performing the adjust
2. Fixing the tightening screw to the fluid box
3. Fixing the Nozzle Fixation Nut
4. Opening/closing Luer-Lock connector
5. Picking up a nozzle insert</td><td> </td></tr>
</table>

Tab. 12: MDT 327 - Multi-Function Tool (Order no. 1014440)

3.3.8 MDT 328 - Tappet Sealing Changing Tool

<table>
<tr><td colspan="2">The MDT 328 is used to mount and demount the tappet sealing and the tappet centering piece.</td></tr>
<tr><td><b>Intended Purpose:</b>
1. Squeezing out of the tappet sealing from the fluid box
2. Squeezing out of the tappet centering piece from the fluid box
3. Pushing the tappet sealing into the fluid box</td><td> </td></tr>
</table>

Tab. 13: MDT 328 - Tappet Sealing Changing Tool (Order no. 1014503)

3.3.9 Hexagon Key Set

<table>
<tr><td colspan="2">The set includes three hexagon keys (sizes 2, 2.5 and 3) for hex-screws, with blades made of hardened steel and ergonomic grips.</td></tr>
<tr><td><b>Intended Purpose:</b>
1. Mounting and demounting the fluid box (2)
2. Mounting and demounting the tappet guard (2)
2. Mounting and demounting the isolation body (2)
4. Mounting and demounting the cartridge holder (2 or 2.5, depending on type)
5. Fixing of the valve, in-situ (3)</td><td> </td></tr>
</table>

Tab. 14: Hexagon Key Set (Order no. 1012993)

3.3.10 MDT 306 - Torque Wrench Tool VM black

The MDT 306 allows you to screw tight screws with an exactly set tightening torque. The value can be adjusted continuously at the torque wrench tool. You can order the necessary bits separately or together with the torque wrench as a set in a tool box (MDTS 1 - Torque Wrench Tool Set TA, order no. 1013521). Additional information is in the Quick Reference Guide "Torque Wrench Tool VM MDT 306". You can download it from the VERMES homepage (www.vermes.com). The necessary password you can get from our sales (sales@vermes.com).	
Intended Purpose: 1. Tightening screw 2. Tappet Centering Screw BY 3. Cartridge holder 4. Fluid box connector Luer-Lock 5. Nozzle Fixation Nut 6. MDC front panel 7. Valve screws	

Tab. 15: MDT 306 - Torque Wrench Tool VM (Order no. 1015062)

3.3.11 Torques (in cN.m)

Element	Gearing Profile	Bit Order No.	Torque (cN.m)		Cross Reference
			Min.	Max.	
Nozzle Fixation Nut (hexagon screw, size M7)	⬢	1014204	150	180	Page 40
Screws for MDC front panel (cross recess screw, size M3)	⊕	1013373	30	40	Page 52
Screws for cartridge holder M 3 x 5 (hexagon socket, size 2)	⬢	1013294	40	50	Page 48
Screws for isolation body M 3 x 5 (hexagon socket, size 2)	⬢	1013294	40	50	Page 42
Tightening screw (gearing VM-A)	●	1014519	120	140	Page 48
Tappet centering screw BY (gearing VM-B)	○	1014521	100	140	Page 40
Connector BY (into mounting body PEEK, hexagon socket, size 2.5)	⬢	1016631	70	80	Page 48
Connector BY (into mounting body metal, hexagon socket, size 2.5)	⬢	1016631	120	140	Page 48

Tab. 16: Torques (in cN.m)

4 Control Unit MDC

This chapter contains relevant information about the control unit. It describes the menu structure, keypad and functions of the control unit.

4.1 Technical Data

	Value
Dimensions	128 mm H x 102 mm W x 173 mm D *(w/o Kabel)* *(see dimensional drawing,* Page 182*)* 3 RU x 20 HP
Weight	ca. 1500 g
Supply Voltage	48 V DC
Current Consumption	Max. 8 A During start-up, this value can increase by a factor of 5 (start-up peak).
Ambient Temperature	10 °C - 50 °C
Air Humidity	The relative humidity rH might not surpass 80% at 31 °C or 50% at 50 °C (connect linearly for other temperatures).
Casing Type	Plug-in case for 19“ rack
Color of Casing	Black, with lighter front panel
Ventilation	Convection
Internal Storage Locations:	10
Display Lines	2 lines with 16 characters each
Display Color	White with background lighting
Keypad	12 softkeys
Color of Keys	Blue, beige
Control Lamps (Front)	1x Heating circuit *(red)* 1x Maintenance *(red)* 1x Cooling/Adjust OK *(green)* 1x Attention/Adjust not OK *(red)*
Control Lamps (Back)	1x Illuminated power lamp
Plug Contacts (Back)	1x Mains plug *(48 V DC)* 1x 9 pin Sub-D RS-232C 1x 15 pin Sub-D PLC 1x AUX-socket 24V 1x Sensor socket 1x Actuator socket 1x Socket for heating 1x Socket for cooling

4.2 Front Side

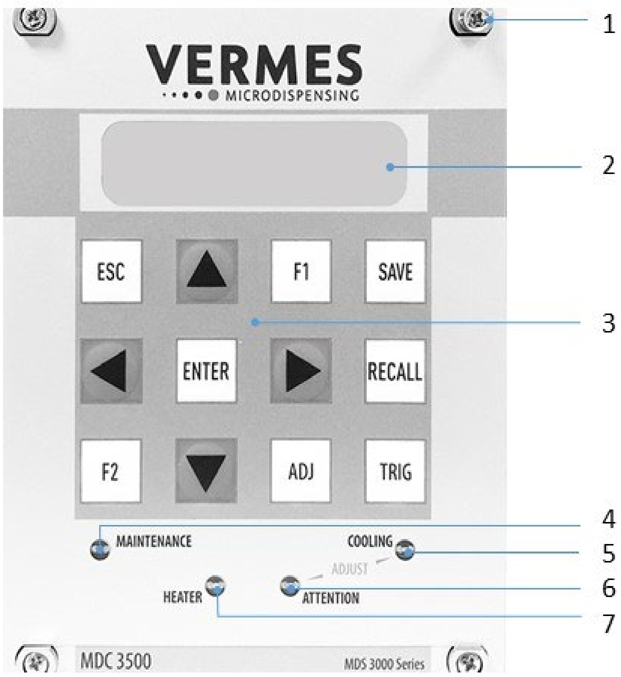


Fig. 1: Front Side

1 Mounting hole
2 LC display
3 Keypad with 12 soft keys
4 Control lamp for maintenance “red”
5 Control lamp for cooling/adjust “green”
6 Control lamp for attention/adjust “red”
7 Control lamp for status of heating “red”

LC display:

Data, service intervals and menu options are shown in the two lines of the illuminated LC display (LCD = “liquid crystal display”). The current menu option appears in the upper line. The lower line contains the current parameter value for dispensing, according to numerical data to be modified.

Keypad with 12 softkeys:

Menu options to control the system are selected by means of these keys.

Details for changing parameters etc. are explained in a following chapter (see paragraph 4.4, page 25).

Control lamp for maintenance:

As soon as this lamp lights up, it is recommended to return the valve to the manufacturer (or licensed subcontractor) for regular periodic maintenance.

Control lamp for cooling/adjust (green):

This green LED has two purposes.

During the adjust, as soon as the LED is ON, the adjust value is OK and can be confirmed by **[enter]**.

Outside of the adjust, it indicates the intensities of cooling (for details, see paragraph 4.5.3.1, page 31).

- More effective cooling, once the actuator temperature goes over 10 °C above the target temperature - LED flashes
- “normal” cooling, if the actuator temperature is within 10 °C above the target temperature - LED ON

Control lamp for attention/adjust (red):

This red LED has two purposes.

During the adjust, the LED lights up, if you screw the adjust screw too far. You have to screw it out according to the instructions of this manual (see paragraph 6.5 "The Adjust Process", page 60).

Outside of the adjust, the LED is ON, whenever the MDC has detected an error.

Control lamp for status of heating:

This red LED indicates the activity of the heating (for more details, see paragraph 4.5.3.2, page 31).

The heater is ON, and the target temperature is reached and stable – LED ON

The heater is deactivated – LED OFF

The heater is ON, but the target temperature is not yet reached – LED flashes

4.3 Back Side

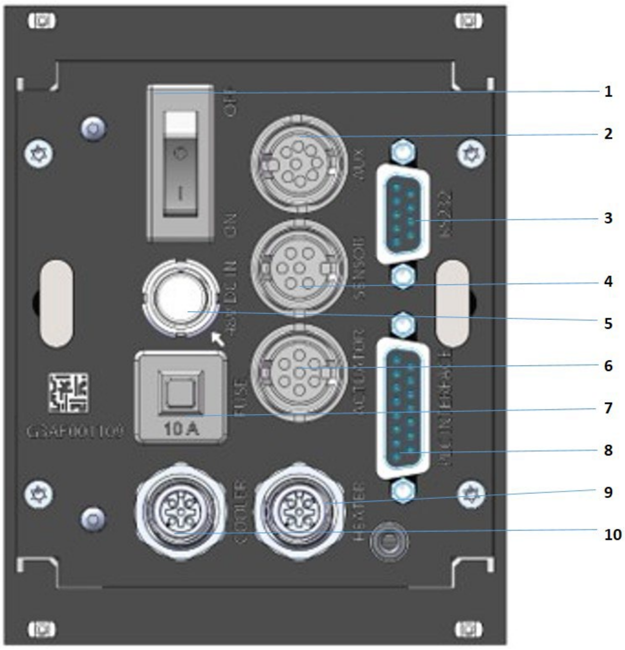


Fig. 2: Back Side

1 ON/OFF switch
2 AUX socket
3 RS-232C interface (9-pin)
4 Sensor socket
5 Power connection

6 Actuator socket
7 10 A fuse
8 PLC interface (15-pin)
9 Socket for cooling
10 Socket for heating

ON/OFF switch:

By means of this switch, the unit is switched ON and OFF.

AUX socket:

This connector can be used for supply of an external device (e.g. an optocoupler) or to control certain parameter setups or scenarios (see paragraph 7.8 "Select Pins", page 72). It is one of the three interfaces of the control unit (see paragraph 8.3, page 135 for the pin assignments).

RS-232C interface (9-pin):

Since the system offers the possibility of external programming of dispensing parameters via PC, a local RS-232C is integrated to receive the data. For the communication protocol, refer to paragraph 8.2.1, page 128.

Sensor socket:

For the connection of the sensor cable.

Power connection:

Connects the control unit to power via an external power supply. The MDC needs 48 V DC. For information regarding the pin functions, see Fig. 3.

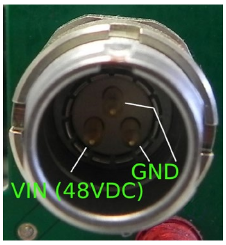


Fig. 3: Connection for power supply 48 V DC – pin functions

Actuator socket:

For the connection of the actuator cable.

10 A fuse:

For the protection of the electronic parts inside of the control unit.

PLC interface (15-pin):

Different inputs and outputs may be connected. For the communication protocol, refer to paragraph 8.1.1, page 89.

Socket for cooling:

The connection cable for FCV (for the valve cooling) has to be connected here.

Socket for heating:

The heater cable has to be connected here.

4.4 Function Keys

Function Key	Function
trig	Manual trigger key Pressing the **[trig]**-key instantaneously launches a dispensing procedure according to the selected parameter settings.
save	The **[save]**-key opens the menu for storing current parameters. Ten storage locations are available for distinct configuration sets. Each set contains values for all pulse parameters. Select the desired storage location by means of arrow keys. Press **[enter]** to confirm. Press **[esc]** to cancel without saving the selection.
recall	Parameter sets saved in the internal memory can be retrieved any time with the **[recall]**-key. Here you can load the settings stored with **[save]**. Use the arrow keys to select one of the ten internal storage locations. Press **[enter]** to confirm the selection. Press **[esc]** to abort.
adj	The **[adj]**-key is used to start the adjust (see paragraph 6.5, page 60). It is required during each initial operation and after an exchange of the nozzle unit. With this procedure, the position of the nozzle insert with respect to the tappet is preselected.
enter	Pressing the **[enter]**-key confirms the menu selection and opens the corresponding submenu. or The entry of a value is confirmed. The screen changes to the next-higher menu level.
esc	Pressing the **[esc]**-key aborts the current action. Values just entered are deleted. The next-higher menu level opens. or Direct access to the next-higher menu level.
⇧	[↑]-key Access to the next-higher menu level. or Increasing of a numerical value.
⇩	[↓]-key Access to the next-lower menu level. or Reduction of a numerical value.

Function Key	Function
←	[←]-key The screen moves one menu step back. or The cursor is shifted one position to the left. or A parameter is modified.
→	[→]-key The screen moves one menu step ahead. or The cursor is shifted one position to the right. or A parameter is modified.
F1	The **[F1]**-key opens the valve, taking into consideration the current values for “Rising” and “Falling”. The Needle Lift used is capped at 80 %. The valve remains opened until the key is released. Maximum length: 2 min. Then the valve closes automatically in order to protect the actuator.
F2	If you start the control unit, while holding the **[F2]**-key, you have the option to format the EEPROM. With **[enter]** you agree, with **[esc**] you skip this point and reach the main menu just as normal. This function will only be necessary in exceptional cases. **Important Note!** Settings for Scenarios will **not** be reset back to the factory settings. That is only possible with the options “Scenario” and “Reset ALL” after entering the service code 1000 (see paragraph 4.5.6 "Submenu “Service-Option”", page 37).

4.5 Menu Structure

The main menu of the control unit MDC 3500-V contains five submenus: “Pulse Parameters”, “Cooler/Heater”, “Status”, “Scenario” and “Service-Option”. With the **[enter]**-key you can reach the level of the submenus. There you can switch around with the keys **[→]** and **[←]**. Another option from the main menu is to use **[→]** or **[←]**, which allows you to gather some information about the system, like maintenance situation or ID numbers. The items are “Tappet”, “Nozzle”, “Date/Time”, “MDC ID”, “Valve ID” and “Firmware Rev.” “Firmware Rev.” will give you the current revision of the firmware on your MDC. “Date” gives the current date and time (as UTC), as the MDC has a real time clock (RTC). Menu levels are always “wrap-around”, i.e. you can move on from the last item in a menu directly on to the first. With **[esc]** or [↑] you can change from a sub menu into the next higher menu level.

The information shown in the display differs, depending on the menu level (see paragraph 4.5.1, page 28).

- Dispensing parameters for a particular process can be recalled and modified in the submenu “Pulse Parameters”.
- “Cooler/Heater” – select the settings for the heating and the valve cooling, if set up.
- You can use the submenu “Status” to decide on individual cycles for the replacement of tappet and nozzle insert (see paragraph 10.1 "Maintenance Indicator", page 153). The current state of the system with respect to the maintenance interval can be verified by the function “Maint. Cycle” (see paragraph 10.1 "Maintenance Indicator", page 153). With “Maint. Message” you can decide to show maintenance messages or not. Error messages concerning the system are shown with the function “Error”.
- In the submenu “Scenario” you can enter values for pre-defined scenarios. Here you can also set the option to work with these scenarios.
- The submenu “Service-Option” is used to enter service codes and to change the baud rate.

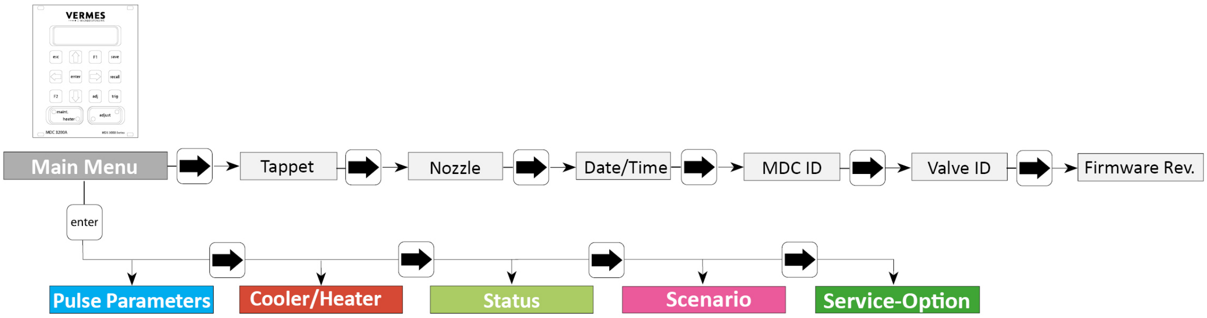


Fig. 4: Main menu

4.5.1 Main Menu

When you switch ON the MDC, you always start in the “Main Menu”. The display shows “Ready” (position 1, see Fig. 6, page 29). With [**enter**] or [↓] you can reach the submenus. For the information on the main level use [→] or [←]. All levels are “wrap-around”, i.e. you can circle around between the items with both keys.

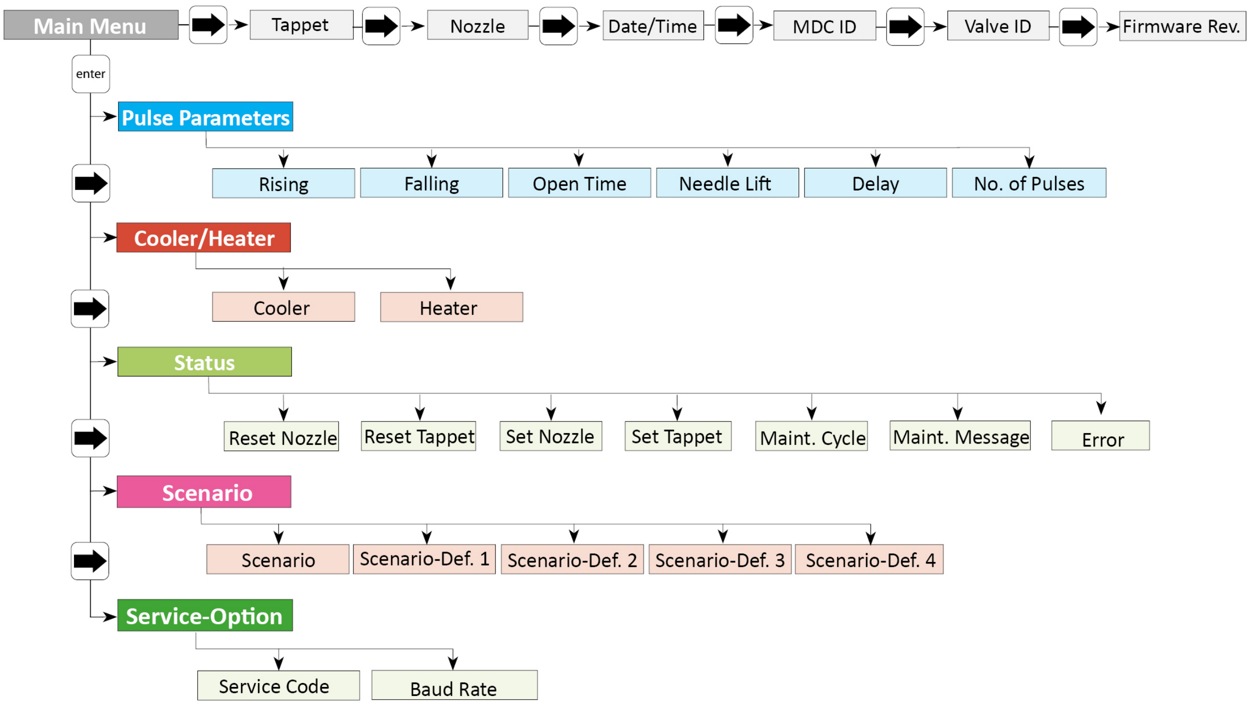


Fig. 5: Menu structure

INFORMATION

Automatic change back to the main menu

On this level, the display jumps automatically back to “Ready”, if you do not press any button for longer than about 10 sec. From the submenus, the display will jump back as well, if no buttons are pressed, but the wait is a bit longer.

In the upper right corner of the display a frequency is shown (position 2, see Fig. 6). This is the dispensing frequency resulting from your current parameter settings. While “Scenario” is “ON”, the word “Scenario” is shown instead (only while entering parameters in the submenu, the frequency is always shown). Next to the frequency, on position 3, one or two letters show the submenu you are in (PP = Pulse Parameters, CH = Cooler/Heater, S = Status, Sc = Scenario, SO = Service-Option).

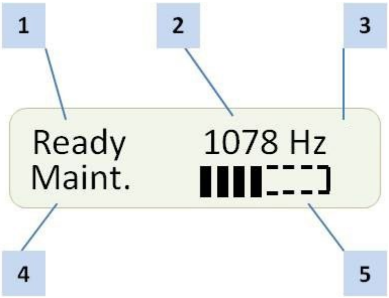


Fig. 6: Display main menu

In the lower line, a maintenance bar is shown (position 5). If all eight sections are filled, maintenance is recommended. Though be aware that this bar is only updated when starting the MDC!

In “Tappet” and “Nozzle” you can see the current values as well as the respective reference value. If a heater is used, instead of “Ready” the current temperature is displayed.

4.5.2 Submenu “Pulse Parameters”

In the submenu “Pulse Parameters”, you can recall and modify dispensing parameters for a particular process. The limits for these parameters you can find in the diagram. You cannot enter values outside these ranges. The values for Rising and Falling are for 80 % Needle Lift. If the Needle Lift is smaller, the values might be lower. The dispensing frequency based on the current parameters is shown in the main menu in the display (position 2, see Fig. 6, page 29), but only, if “Scenario” is “OFF”.

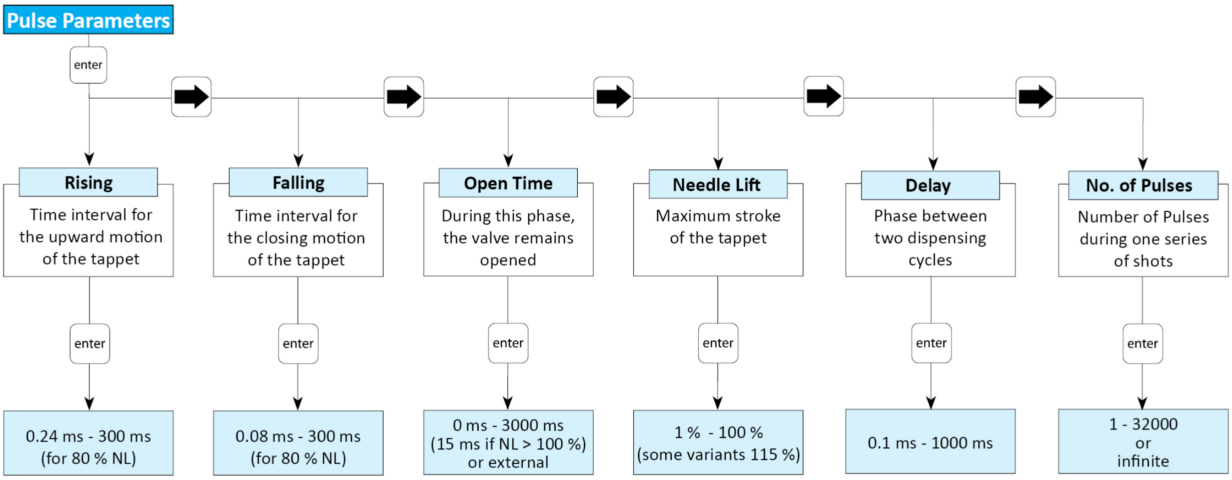

Pulse Parameters
enter
Rising
Time interval for the upward motion of the tappet
enter
0.24 ms - 300 ms (for 80 % NL)
Falling
Time interval for the closing motion of the tappet
enter
0.08 ms - 300 ms (for 80 % NL)
Open Time
During this phase, the valve remains opened
enter
0 ms - 3000 ms (15 ms if NL > 100 %) or external
Needle Lift
Maximum stroke of the tappet
enter
1 % - 100 % (some variants 115 %)
Delay
Phase between two dispensing cycles
enter
0.1 ms - 1000 ms
No. of Pulses
Number of Pulses during one series of shots
enter
1 - 32000 or infinite

Fig. 7: Submenu „Pulse Parameters“

4.5.3 Submenu “Cooler/Heater”

A Microdispensing System MDS can be equipped with a heater or a cooling valve. For heating, you can use a 48 V heater (e.g. Heater MDH-48-BY, order no. 1014231). For cooling, you can use a flow control valve (e.g. Flow Control Valve FCV-AC 6.0 M12, order no. 1016265).

INFORMATION

MDC detects the heater and the cooler during start-up

During start-up, the MDC also checks if a heater and/or a flow control valve is connected. The messages “Heater connected” (or “Heater is disconnected!”) and “Cooler connected” (or “Cooler is disconnected!”) will be displayed. When a heater is connected, the display switches between the message “Heater connected” and the message “press enter” (see Fig. 8). You need to press the [**enter**]-key to confirm it.

Heater
connected

press enter

Fig. 8: Message “Heater connected - press enter”

⚠ CAUTION

Danger of burns through high temperatures!

The heater can reach temperatures of up to 180 °C.

- Do not touch this area during operation.
- And afterwards only touch it once it has cooled down.

By using a heater, the dynamical viscosity of the fluid to be dispensed can be controlled. For some liquids, dispensing without heating is impossible. Heating may also be required to ensure a constant process temperature, or when the dispensing has to take place above room temperature.

To reach a certain target temperature takes time. This time is influenced by many different circumstances, e.g. the outer temperatures.

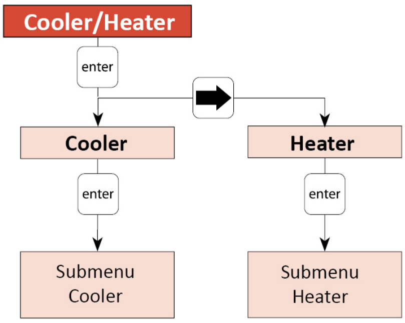


Fig. 9: Submenu “Cooler/Heater”

All relevant functions of the heater and the cooling valve can be set in this submenu. With “Cooler” you can reach the submenu for the cooling settings (see paragraph 4.5.3.1, page 31). With “Heater” you can reach the submenu for the heater settings (see paragraph 4.5.3.2, page 31).

4.5.3.1 Submenu Cooler

This submenu has three menu items.

⚠ CAUTION

Avoid uncontrolled compressed air release

An uncontrolled release of compressed air can cause damages and injuries. Therefore, your controlling machine needs to have a stopcock with air vent. Additionally, your XY-machine needs to follow the directives for working with compressed air.

To reach a certain target temperature takes time. This time is influenced by many different circumstances, e.g. the outer temperatures.

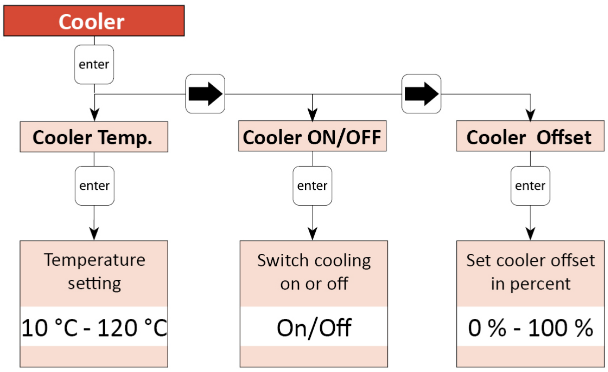


Fig. 10: Submenu “Cooler”

All relevant functions of the cooling system can be set in this submenu. With “Cooler Temp.”, you can set the temperature with an accuracy of 0.1 °C. With “Cooler ON/OFF”, you can switch the cooling valve ON or OFF. “Cooler Offset” allows you to set a cooler offset in percent (see paragraph 7.14.2 "Cooler Offset", page 87). This cooler offset provides an offset value for the flow control valve, which is independent from the regulation system. The value is given as a percentage value.

In case the cooler is turned ON, if the actuator temperature is more than 10 °C above the target temperature, the systems starts a more effective cooling. During this fast cooling phase, the green Cooling LED flashes. Once the actuator temperature falls within 10 °C above the target temperature, the green Cooling LED no longer flashes, but is ON. For exact dispensing results, the actuator temperature should stay below 80 °C. If the Error 502 appears (see paragraph 11.2, page 158), dispensing is only again possible after the actuator temperature falls below 80 °C.

To check information about the cooler (e.g. status, temperatures) via RS-232C interface, send the command “COOLER:?” (for details see paragraph 8.1.2.3, page 95).

4.5.3.2 Submenu Heater

This submenu has two menu items.

⚠ CAUTION

Danger of burns through high temperatures!

The nozzle heater can reach very high temperatures.

- Do not touch this area during operation.
- And afterwards only touch it once it has cooled down.

- If possible, wear heat resistant gloves.

To reach a certain target temperature takes time.

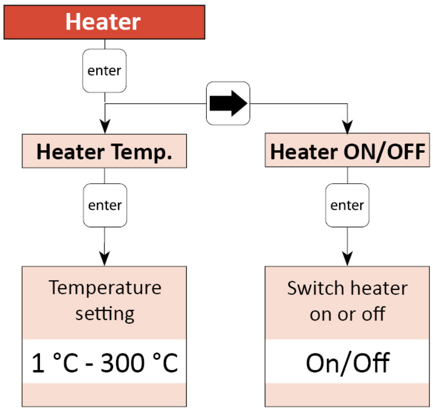


Fig. 11: Submenu “Heater”

All relevant functions of the heater can be set in this submenu. With “Heater Temp.”, you can select the temperature values with an accuracy of 0.1 °C. The maximum temperature you can set at the MDC is 300 °C, but the effective maximum depends on the connected heater (e.g. a maximum of 180 °C with MDH-48-BY). With “Heater ON/OFF”, you can switch the heater ON and OFF.

For an example of the display see Fig. 12, when the heater is switched ON, but the target temperature is not reached yet. The target temperature is shown instead of “Ready” in the upper left corner of the display. Instead of dispensing frequency, the current temperature is refreshing in the upper right corner of the display. During this phase, the red Heater LED flashes.

Fig. 12: Before reaching the target temperature

When the target temperature is reached and stable, the dispensing frequency is shown in the upper right corner of the display (as an example, see Fig. 13, page 32). The red Heater LED no longer flashes, but stays ON.

Fig. 13: The target temperature is reached

IMPORTANT NOTE

Target temperature must be above ambient temperature

The target temperature you set must be higher than the ambient temperature. Otherwise, the heater works continuously without reaching the target. E.g. a target temperature of 25 °C can make sense, if the ambient temperature is 20 °C. But with an ambient temperature of 30 °C, a target temperature of 25 °C would be too low.

To check information about the heater (e.g. status, temperatures) via RS-232C interface, send the command “HEATER:?” (for details see paragraph 8.1.2.3, page 95).

4.5.4 Submenu “Status”

“Maint. Cycle” refers to the unit as a whole and cannot be modified by the user. For the nozzle and the tappet however, it is possible to determine a fix number of cycles before replacing the concerning items and to reset the counters after exchange. In “Maint. Message” you can decide to show or hide the maintenance messages (for more information regarding all aspects maintenance, see paragraph 10.1, page 153).

“Error” shows the latest error messages of the system (up to 50), with date and time (UTC). Help to solve error messages you will find in paragraph 11.2, page 158.

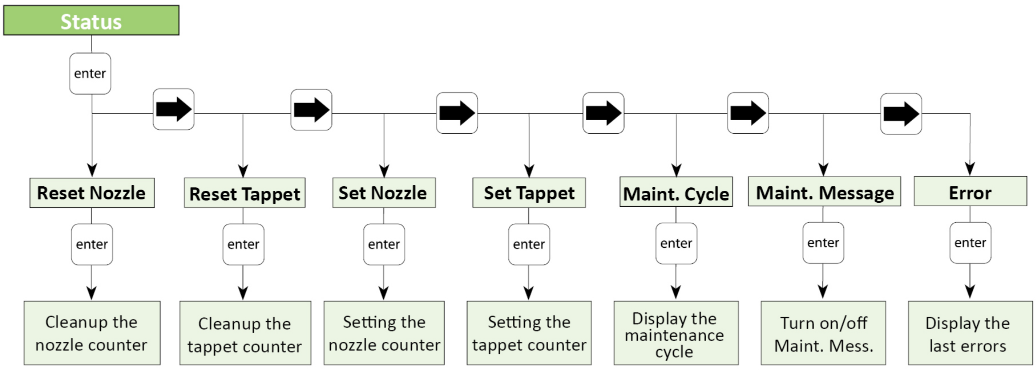


Fig. 14: Submenu “Status”

4.5.5 Submenu “Scenario”

In the submenu “Scenario” you decide if you want to work with scenarios (see paragraph 7.9.1 "Basics about Scenarios", page 74). You can also enter parameters for pre-defined scenarios. Each of the four potential scenarios has its own submenu, where you can set those parameters. The second diagram explains the structure of these submenus. Check there to find the possible limits for those parameters.

With **[→]** and **[←]** you can switch between the four scenarios.

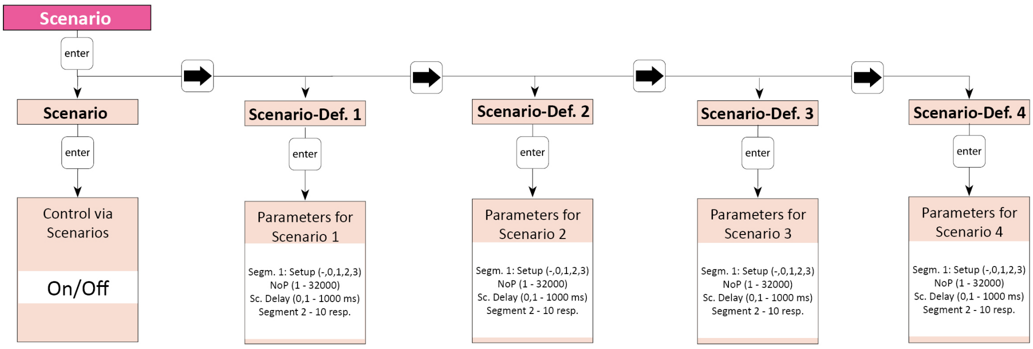

Scenario
enter
Scenario
enter
Control via Scenarios
On/Off
Scenario-Def. 1
enter
Parameters for Scenario 1
Segm. 1: Setup (-,0,1,2,3)
NoP (1 - 32000)
Sc. Delay (0,1 - 1000 ms)
Segment 2 - 10 resp.
Scenario-Def. 2
enter
Parameters for Scenario 2
Segm. 1: Setup (-,0,1,2,3)
NoP (1 - 32000)
Sc. Delay (0,1 - 1000 ms)
Segment 2 - 10 resp.
Scenario-Def. 3
enter
Parameters for Scenario 3
Segm. 1: Setup (-,0,1,2,3)
NoP (1 - 32000)
Sc. Delay (0,1 - 1000 ms)
Segment 2 - 10 resp.
Scenario-Def. 4
enter
Parameters for Scenario 4
Segm. 1: Setup (-,0,1,2,3)
NoP (1 - 32000)
Sc. Delay (0,1 - 1000 ms)
Segment 2 - 10 resp.

Fig. 15: Submenu “Scenario”

To enter the parameters for a scenario, press **[enter]** on the respective submenu “Scenario-Def.” The structure of these submenus is explained in the picture below (see Fig. 16, page 36).

In “Sc:1.1 Setup” you can enter “0”, “1”, “2” or “3” to select a setup or “-”, to decide that no further segment will follow. “0” is the working configuration, “1” to “3” are the parameters of the respective setups 1 to 3. Then the scenario will end with this segment and the menu will stop here as well. (If you later change the “-” to the number of a setup, the following segment will be unlocked again in the menu.) If you set the blank directly in the first segment, the system will simply use the working configuration instead of the scenario.

After entering a setup and **[→]**, you can select the Number of Pulses next. This NP replaces the one from the setup, which would be otherwise used. Another **[→]** gives the option to enter a scenario delay. Standard value is 10 ms.

Another [→] brings you to the second segment in your scenario (“Sc:1.2 Setup”), where you have the same options as with the first. All in all you can combine up to ten segments (though only four different setups, since only setups 0 to 3 are available), each with its own NP and scenario delay, unless you stop your scenario beforehand by selecting “-” instead of a setup. After the last segment, another [→] brings you the option to set the PLCStop “ON” or “OFF”. With “ON” a scenario always ends automatically, once the trigger signal drops to “low”. No further segments of the scenario will be performed. With the PLCStop “OFF”, the trigger signal only matters, if the NP in a setup is set as “infinite”. With these parameters will be dispensed until the trigger signal drops to “low”. If the trigger signal is already “low” when reaching the signal, only one pulse will be shot. Then the next segment of the scenario will follow after the scenario delay (unless, of course, it was already the last segment of the scenario).

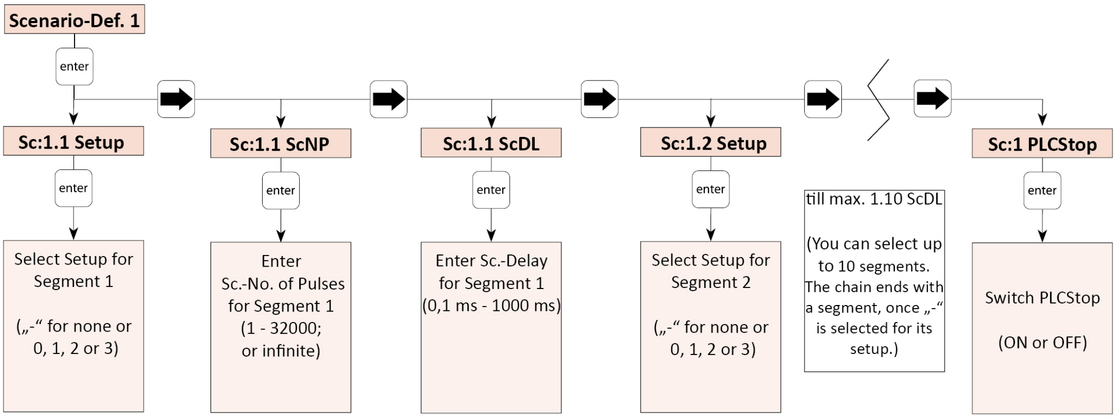

Scenario-Def. 1
enter
Sc:1.1 Setup
enter
Select Setup for Segment 1
(„-“ for none or 0, 1, 2 or 3)
Sc:1.1 ScNP
enter
Enter Sc.-No. of Pulses for Segment 1 (1 - 32000; or infinite)
Sc:1.1 ScDL
enter
Enter Sc.-Delay for Segment 1 (0,1 ms - 1000 ms)
Sc:1.2 Setup
enter
Select Setup for Segment 2
(„-“ for none or 0, 1, 2 or 3)
till max. 1.10 ScDL
(You can select up to 10 segments. The chain ends with a segment, once „-“ is selected for its setup.)
Sc:1 PLCStop
enter
Switch PLCStop
(ON or OFF)

Fig. 16: Submenu “Scenario-Def. 1”

INFORMATION

Finding PLCStop quickly

If you just want to change the PLCStop setting, but not any of the segments in your scenario, it is quickest to use **[←]** once after entering the scenario, since this submenu is wrap-around, just like all other.

4.5.6 Submenu “Service-Option”

This menu has two sections. In “Service Code” you can enter a service code (see Tab. 17).

“Baud Rate” is used to change the baud rate. There are five possible values: 9600, 19200, 38400, 57600 and 115200 (new MDCs are set to 115200).

Service Code	Explanation
33	If you enter 33, you can activate or change the adjust offset (see paragraph 7.12 "Adjust Offset", page 81).
1000	If you enter 1000, you enter a further submenu containing the options listed in the table below (see Tab. 18).
4000	If you enter 4000, you can de-/activate the multi dot mode in the Scenario Mode (see paragraph 7.9.4, page 76). Default setting is OFF. **Information!** You can only activate the Multi Dot Mode, while the Scenario Mode is ON.

Tab. 17: List of service codes

Option	Explanation
SingleDosOK	You can select between the possibilities that the SingleDosOK signal is switched per pulse or per setup. (Default setting is per pulse. For the pin configuration of the PLC interface, see paragraph 8.2.1, page 128.)
DosOK with Delay	You can select, if before switching the signal DosOK there should be one delay executed at the end. (Default setting is OFF.)
Auxiliary Mode	Here the auxiliary mode can be switched ON or OFF (see paragraph 7.11 "Auxiliary Mode", page 80).
Factory Settings	Here any parameters can be returned to the default factory settings (see paragraph 7.10 "Factory Settings", page 79). You have got four alternatives: • Setup 0 – 3 (the parameters of the working configuration and the setups 1 to 3 are returned to the factory settings) • Reset ALL (all parameters are returned, including the settings of the scenarios; also the heater will be turned OFF and the temperature set to 10°C, cooling will be turned OFF, set to 80 °C and the cooler offset will be set as 0 %) • Scenario (the parameters and settings of the scenarios are returned to the factory settings) • Setup ALL (the parameters of the working configuration and all setups are returned, setups 4 – 10 receive values of setup 0)

Tab. 18: Options in the submenu of service code 1000

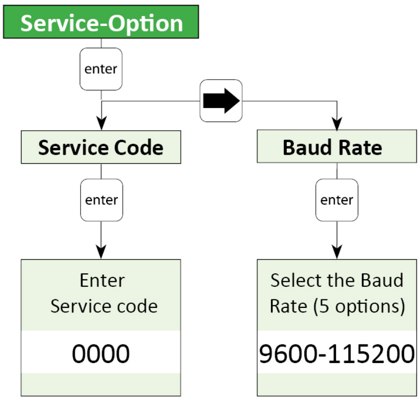


Fig. 17: Submenu “Service-Option”

4.6 Memories of the MDC

The MDC contains several memories to save parameter setups.

The first one is the RAM (Random Access Memory). Here the parameters of the current dispense process will be saved. This memory will be erased when the controller is switched of or disconnected from power. When starting again, the MDC will load the first of eleven parameter memory sets saved on the EEPROM (Electrically Erasable Programmable Read Only Memory) into the RAM. This first parameter setup is also called the “EEPROM current working parameter configuration”, or short “working configuration” or “EEPROM working configuration”.

The parameter set in the EEPROM working configuration is usually the same as the parameter set saved in the RAM memory. When using the keypad to program the controller, the two memories will always have the same contents. The only way to create a difference in the parameter set saved in the RAM and in the EEPROM working configuration is by using some special commands through the RS-232C.

The remaining ten EEPROM memory sets can be used to save different parameter setups when programming the controller through the keypad interface (use the command **[save]**).

In order to change the values saved in the EEPROM working configuration you may use the MDC keypad (enter the parameters in the menu “Pulse Parameters”, then press **[enter]**).

Or you may use one of the following commands via RS-232C:

- TRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- TRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- STRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1
- STRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>,1

All values transmitted to the control unit by one of the following commands will not be saved in the EEPROM working configuration.

- TRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- TRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- STRIGGER:SET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>
- STRIGGER:ASET:<Rising>,<Open Time>,<Falling>,<Needle Lift>,<Number of Pulses>,<Delay>

Instead it will remain in the RAM memory until erased by another RS-232C command, or when the control unit is switched OFF and the EEPROM is read out into the RAM during restart. The reason for having these two different types of commands (the distinction is the “1” at the end) is that it takes up to 1 sec to save the parameter set in the EEPROM.

On top of the working configuration and the ten parameter setups there is another parameter set-ting saved in the software on the EEPROM. This is called the “factory setting”. It cannot be changed by the user. It may be loaded to the working configuration and the RAM memory after major disturbances of the system.

Additionally there is the possibility to save combinations of setups, so called “Scenarios” (see paragraph 7.9 "Scenarios", page 74).

5 Microdispensing Valve

This chapter contains relevant information about the valve. It describes the structure and the hardware configuration.

5.1 Composition of the Valve

The Microdispensing valves of Vermes Microdispensing are modular. A valve is composed of seven different modules:

- Valve body (includes Electronics module and Actuator system) (1)
- Tappet (not visible) (2)
- Tappet sealing (not visible) (3)
- Nozzle insert (not visible) (4)
- Nozzle fixation nut (5)
- Heater MDH-48-BY with fluid box (6)
- Media supply (7)

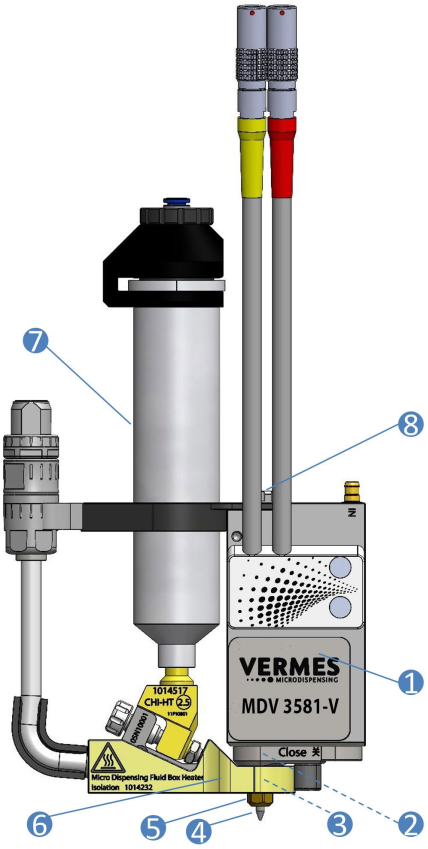


Fig. 18: Composition

The valve body (1) accommodates the electronics module, the actuator system, the adjust screw and the tappet (not visible in the picture). The electronics module holds the electronics to receive the actuator and sensor signals. Here are the connectors for sensor cable and actuator cable integrated in the surface of the case; they have to be linked to the control unit. The electronics module is connected to the actuator system, representing the core of the microdispensing valve. The actuator system houses the sensor, the piezoelectric element and the mechanics to drive the tappet. Actuator case and mechanics are sealed for protection against dust and contamination. The adjust screw (8) is at the top end of the valve body.

At the bottom of the valve is the inlet where the tappet (2) runs. The tappet can be exchanged. Powered by the actuator the tappet moves with high speed back and forth. It hits the dispensing medium and presses it through the opening of the nozzle insert. Tappets can be made of ceramics, of carbide metal or of poly diamond. They can have different forms or sizes. A tappet should be checked and cleaned regularly or exchanged if necessary (see paragraph 10.2.1 "Maintenance of the Tappet", page 154).

The connection between valve body and fluid box is made up of the tappet sealing (3). There are different types of tappet sealings, e.g. the Tappet Sealings PE and Tappet Sealings PTFE, which have to be used together with a tappet centering piece.

A small but important module is the nozzle insert (4), which has to be considered as a wearing part. Thanks to the bayonet fluid box, it can easily be cleaned and exchanged in case of need. VERMES Microdispensing offers a large selection of different nozzle inserts to allow for optimum dispensing results, according to the current application. They can differ in form and material.

The nozzle fixation nut (5) contains the nozzle insert (NI).

The fluid box (6) is integrated into the heater MDH-48-BY. It is thermally isolated from the actuator system. Its purpose is to transport the liquid from the cartridge or the tank to the nozzle fixation nut. In order to simplify independent cleaning, this module can easily be disengaged from the valve, just by one click, thanks to the bayonet system. Information how to assemble a fluid box you can find in paragraph 9.4.5, page 149. In case you need no heating for your application, you can use the Mounting Body BY (order no. 1014369) instead of the heater MDH-48-BY.

The media supply (7) supplies the dispensing medium and is connected with the fluid box. VERMES Microdispensing GmbH has many different configurations available (see paragraph 13.4, page 175). For smaller amounts to be dispensed you can use a cartridge. They come in different sizes and types. For larger amounts, you can use a tube connector to connect a pressure tank with the fluid box.

5.2 Explosion View Valve

The explosion view of an MDV 3581-V. Usually the cable connections point upwards, but on request, they can be oriented differently, so that the cables point to the side. You can change the orientation of the compressed air connections according to your needs. To do so, you will need a hexagon key, size 1.5.

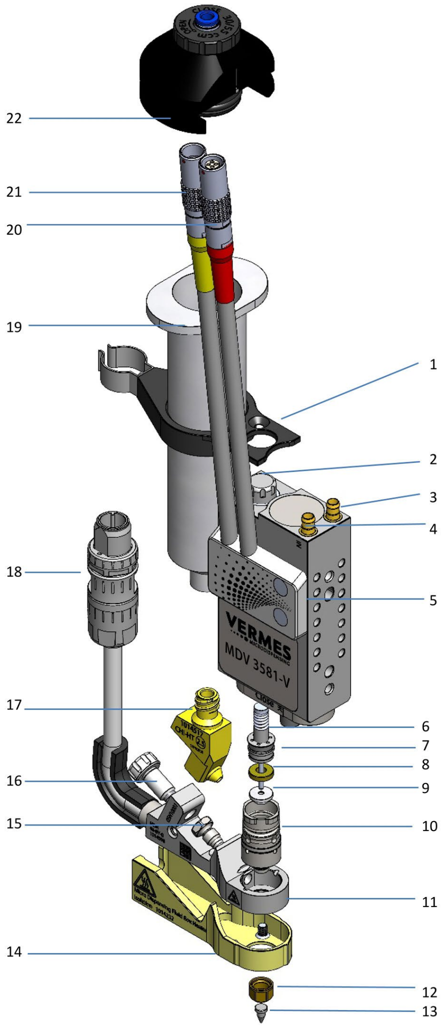


Fig. 19: Explosion view valve

1	Cartridge holder
2	Adjust screw
3	Connections for compressed air for valve cooling – in (use optional)
4	Connections for compressed air for valve cooling – out (use optional)
5	Microdispensing valve
6	Tappet rod with tappet spring
7	Tappet centering screw
8	Tappet centering piece
11	Heater MDH-48-BY
12	Nozzle fixation nut
13	Nozzle insert
14	Isolation body (optional)
15	Connector BY
16	Tightening screw
17	Cartridge base CHI
18	Connection for heater cable
19	Cartridge
20	Cable connection – Actuator (red)

9 Tappet sealing PE
10 Fluid box body with O-ring BY

21 Cable connection – Sensor (yellow)
22 Connection for compressed air

5.3 Technical Data

Parameter	Value
Inlet Pressure Range	Depending on the supply unit (e.g. cartridge or pressure tank)
Dynamic Viscosity of Fluids	Medium to high viscosity up to 2000000 mPas
Response Time (PLC-interface)	ca. 130 µs
Dispensing Frequency (max.)	> 3 kHz
Dispensing Frequency (average)	> 1 kHz
Compatibility	all aqueous fluids, organic solvents, weak acids and bases
Dimensions (MDV 3581-V)	92.1 mm x 41.5 mm x 25 mm
Weight (MDV 3581-V)	ca. 420 g (depending on configuration)
Position of Tappet in Absence of Voltage	open

5.4 Special Features of the Valve

Normally Open

In its not energized state, i.e. in absence of voltage, the valve remains in open position, so that the tappet tip does not block the channel of the nozzle insert. The liquid in such a situation therefore may flow. In reality, this fact does not represent a problem, since for this model, usually high-viscous media are processed which in worst case drain off very slowly.

It is recommended however, that users bear this fact in mind, and reduce the supply pressure to atmospheric pressure during longer interruptions and before switching OFF the unit.

With PX2 Technology

The microdispensing valve uses PX2 technology (VERMES **P**iezo **X**treme **2**), a new piezo technology developed and patented by VERMES Microdispensing. With PX2 technology, the valve is perfectly suited for high frequency and heavy duty applications. The piezo is encapsulated, which means it has a longer lifetime in humid or dusty environments.

With Bayonet Fluid Box

Thanks to the bayonet system, the fluid box can be removed easily with just one click from the valve. There are no screws. This allows for a very quick exchange of nozzle fixation nut and nozzle insert or of the tappet for cleaning or maintenance purposes. Afterwards you have to carry out the adjust, in order to establish a convenient position of the nozzle insert with respect to the tappet. This way a reproducible process remains ensured.

Highest Flexibility

Due to the modular design of the series, nozzle units and fluid boxes can be exchanged easily. This allows at any time for a quick adaption of the system configuration to new applications. A comprehensive choice of accessories is also available for special circumstances.

These modifications can be performed in no time, avoiding downtimes for the process. Ordering the equipment already at an early stage however is recommended; do not forget to specify the relevant data (Valve ID etc.). Consult our Technical Support beforehand, if special parameters have to be taken into consideration.

Functionality Independent of the Position

The functionality of the valves does not depend on the fitting position, considerably simplifying the integration into an existing process.

User-friendly Design

The control unit does not give rise to compatibility problems with respect to the other components of a complex process structure. Service is possible by keypad or, thanks to the integrated RS-232C, by remote PC.

Secure Wiring

The valves are equipped with high-quality Lemo connectors. Those can be connected and disconnected easily, but hold secure against any accidental opening.

Comprehensive Material Selection

Only the best materials are used for the production of Vermes Microdispensing valves.

- All parts in contact with the transported medium consist of high-alloy special steel, rust- and acid-resisting, or modifications of high-duty polymers of the PE (Polyethylene), PEEK (Polyetheretherketone) and PTFE (Polytetrafluoroethylene) family.

- Sealings can be made of different materials. You can find notes regarding heat resistance and chemical resistance in paragraph 9.2, page 137 and paragraph 9.3, page 138.
- For nozzle inserts, special steel, stainless steel, ceramics and PEEK options are permanently in store, allowing for perfect tailoring of the configuration to the needs of the particular application.

6 Initial Operation

6.1 Delivery

VERMES systems are shipped in carefully packed state. Transport damages however can never be totally excluded, and deadlines stated in insurance contracts should not be exceeded.

6.1.1 Unpacking

After receiving the merchandise:

- Check the package visually for any kind of damage.

If yes:

Detected damages must be notified to the carrier. As soon as the complaint has been confirmed in writing, contact the responsible forwarder and inform VERMES Microdispensing.

If no damage is detected:

- Open the package.
- Remove any contained subcomponents and parts of the microdispensing system from the package and check the delivery for completeness.

6.1.2 Content

According to the purchase order, the following components may be included; some of them are already preassembled:

1 Control unit MDC
2 MicroDispensing Valve MDV
3 Fluid box*
4 Nozzle fixation nut*
5 Nozzle insert*
6 MDT 303 - Nozzle Insert Changing Tool
7 MDT 329 - L-Shape hexagon Key 2 mm
8 MDT 327 – Multi-Function Tool
9 Tappet Grease TF 1 ml syringe
10 MDT 323 - Nozzle Insert – Squeezing Out Tool TA
11 Actuator cable (red)*
12 Sensor cable (yellow)*

*These parts are included only, if ordered explicitly.

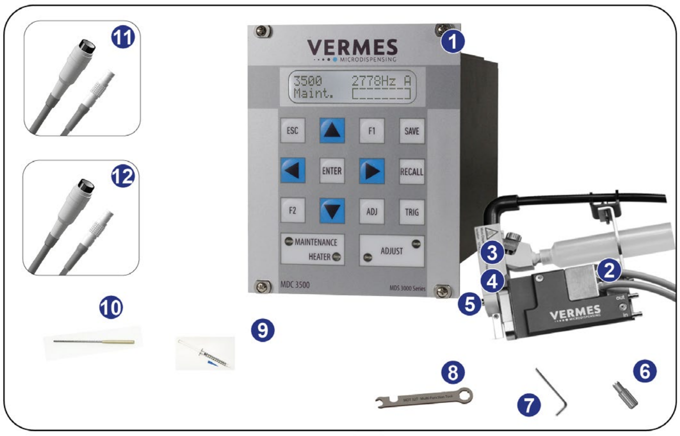


Fig. 20: Content

Options	Recommended options
Different models of fluid boxes Different fluid box connectors Nozzle heating	Cleaning set MDT 301 - Universal Tool MDT 306 - Torque Wrench Tool MDT 324 - Nozzle Insert Cleaning Holder

If the intended application needs particular accessories (e.g. seals made of special material), consult our Technical Support at once (see Page 7). Do not start the system in incomplete state.

6.2 First Assembling of the Valve

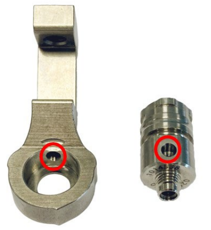
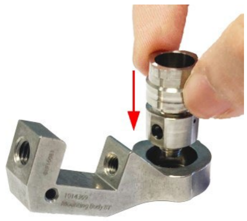
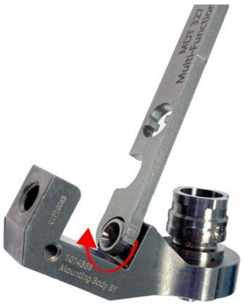
This chapter describes how to ready your microdispensing system for the first dispensing session. Always make sure all screw couplings sit tight (torque values in paragraph 3.3.11, page 19).

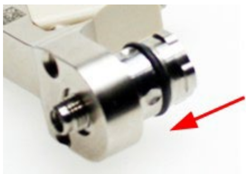
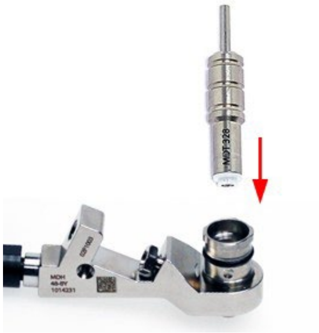
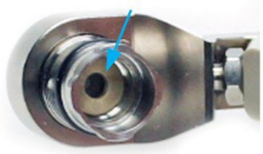
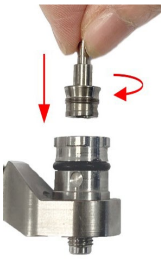
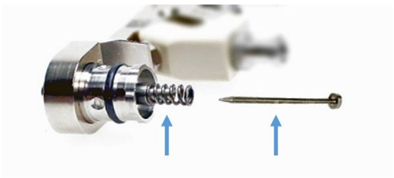
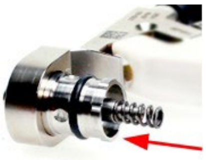
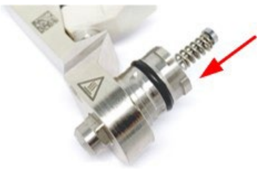
INFORMATION

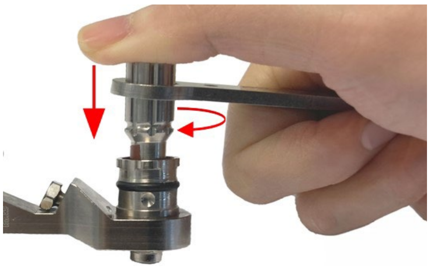
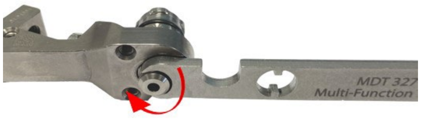
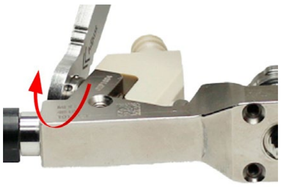
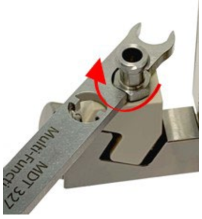
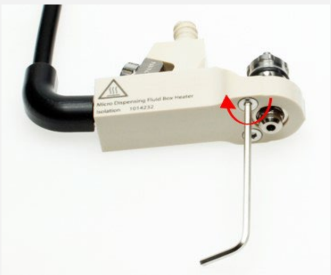
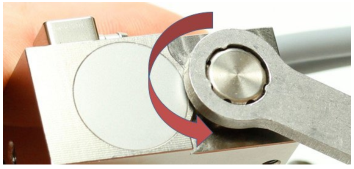
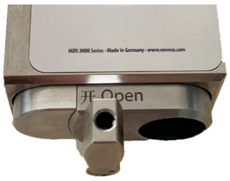
Some parts preassembled

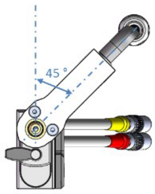
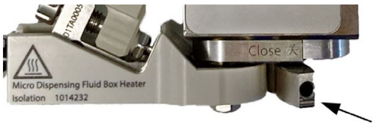
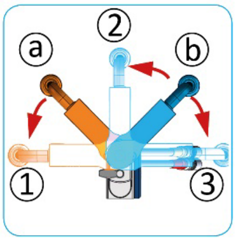
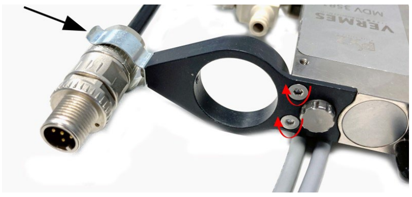
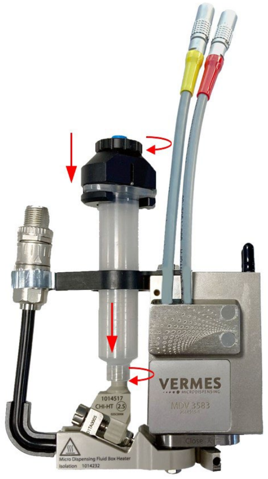
Some elements of the equipment are usually delivered in preassembled state. In those cases, you can omit the respective steps.

Proceed as follows:

Picture	Explanation
  	**Step 1 (fluid box body)** **Information!** This step will be optional, if you re-assemble the valve later, since usually you would not remove the Connector BY from the mounting body. Place the fluid box body on the receptacle of the mounting body. Align the bore on the fluid box body with the bore on the mounting body (see circles in the first picture). The fluid box body will sit in the mounting body. Push the Connector BY through the mounting body into the bore of the fluid box body. Screw the Connector BY tight (clockwise) by using an MDT 327 (for newer revisions of the Connector BY you can also use a hexagon key 2.5 or the MDT 306 - Torque Wrench Tool VM with the Bit Hexagon Key 2.5). Torques are depending on the material of the mounting body (stainless steel 120 – 140 cN.m, PEEK 70 – 80 cN.m). **Important Note!** Do **not** press the fluid box body while fastening the Connector BY. Otherwise, the Connector BY cannot correctly grip into the fluid box body.

	**Step 2 (O-ring)** In case that you received the O-ring separately, you have to mount it onto the fluid box body. Pull the O-ring over the fluid box body with a pair of tweezers. Be careful not to damage the O-ring.
	**Step 3 (tappet sealing)** Use MDT 328 - Tappet Sealing Changing Tool to press the Tappet Sealing PE/PTFE/HT into the fluid box body until it sits tight.
	**Step 4 (tappet centering piece)** Press the tappet centering piece into the fluid box body. Use the wide end of the MDT 323 - Nozzle Insert - Squeezing Out Tool TA. Make sure the tappet centering piece rests flat. **Important note!** You do not need a tappet centering piece, if you use a 2G tappet rod.
	**Step 5 (tappet and tappet centering screw)** Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.
  	**Important note!** Before mounting, please place a small droplet of Tappet Grease TF (Order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet spring (for placing see blue arrows in the picture). Make sure that the tappet tip is free of grease. Rotate the tappet and pull it in and out for three times to spread the grease. Place the tappet spring over the Tappet Centering Screw BY. Push the tappet rod through the tappet spring into the Tappet Centering Screw BY. Make sure that the tappet goes through the tappet sealing.

	Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 140 cN.m) with MDT 303 - Nozzle Insert Changing Tool. Make sure the three pins of the MDT 303 fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage.
	Step 6 (nozzle insert) Clip the nozzle insert into the fluid box. Use the small hole of MDT 327 - Multi-Function Tool to pick up the nozzle insert and to place it. Make sure the nozzle insert sits flat.
	**Step 7 (nozzle fixation nut)** Screw the nozzle fixation nut clockwise onto the fluid box. Use MDT 327 Multi-Function Tool.
 	**Step 8 (cartridge base)** Place the cartridge base onto the fluid box and fix it with the tightening screw. Screw the tightening screw clockwise with MDT 327 Multi-Function Tool (torque 120 – 140 cN.m). **Important note!** In case you use a Cartridge Base without integrated luer lock, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base CH. Use the open-ended wrench of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).
	**Optional (isolation body)** For thermally sensitive applications, you might use an isolation body. Pull it onto the fluid box, until it clips in. Screw it tight with the two screws for the isolation body (torque 40 – 50 cN.m). Use the MDT 329 - L-Shape hexagon Key 2 mm.
	**Step 9 (adjust screw)** Open the adjust screw completely. Screw counter-clockwise. Use MDT 327 Multi-Function Tool.
	**Step 10 (fluid box)** Turn the locking lever by 180° from “Close” to “Open” position.

  Close Micro Dispensing Fluid Box Heater Isolation 1014232	Push the fluid box carefully in a 45° angle onto the valve. Straighten the fluid box and close the locking lever.
	**Optional positions** The bayonet fluid box has three different locking positions (1: 90°, 2: 0°, 3: +90°) in which the valve can be operated. To fix in locking position 1, mount the fluid box at position a. To fix in locking position 2 or 3, mount the fluid box at position b.
	**Step 11 (cartridge holder)** Screw the cartridge holder on top of the valve body (torque between 40 – 50 cN.m). Use the MDT 329 or a hexagon socket key size 2. Depending on the size of the cartridge, you have to select the correct cartridge holder. Hook the heater connection of the fluid box into the cartridge holder (see black arrow).
	**Step 12 (cartridge and compressed air adapter)** Push the cartridge through the cartridge holder and screw it clockwise into the thread of the cartridge base. Finally, push the compressed air adapter onto the cartridge and screw it tight.

Tab. 19: Assembling of the valve

6.3 Installation of the Microdispensing System

Prior to installation, verify the conditions in the intended location, with respect to the specification of the system and information detailed in this chapter.

The control unit and the valve have to be installed strictly in conformity with the procedures described below. The system requires:

- Power supply
- Pneumatic supply

INFORMATION

Read chapter “Safety Notes” first

The entire procedure of installation is reserved to persons reliably informed about the safety considerations (see chapter 2, page 8).

6.3.1 Installation of the Control Unit

The control unit is designed as a 19” plug-in module, which has to be fixed in the corresponding rack by means of four pan-head screws at the front side. Leave sufficient space around the unit to simplify service. Ventilation should be available. Recommended are cases complying with enclosures according to EN 61010-1 with regard to fire protection.

IMPORTANT NOTE

Potential damage to the control unit

Do not close the four pan-head screws too tight; otherwise the front panel can be damaged (see torque table paragraph 3.3.11, page 19).

To avoid overheating and ensure the required ventilation, a minimum distance between the control unit and any other object should be maintained (at least 1.5 cm). Heat should neither be accumulated nor externally be introduced. Do not obstruct natural convection. Ventilation from the bottom side and air exhaust above is important. Minimum width of ventilation openings is 8 cm x 8 cm.

For high-duty applications (from ca. 300 Hz) or in the case of an air cooled model (AC variants), a rack with separate ventilation is advisable, since in these situations an airflow of 30 m^3/h for each control unit is compulsory.

6.3.2 Installation of the Valve as Part of a Machine

Preferably, mount the valve on an automatic XYZ table or in a similar device (XYZ positioning system). Stable seat at the fixture of Z-axis is imperative, as the valve should not become loose during the dispensing process. For this purpose, insert two M4 hex screws to a depth of 4 mm, through the bores located at the narrow side of the valve. Their distance center to center amounts to 45 mm. To improve accuracy when positioning the valve on a receptacle, additionally use the alignment bore and the long hole, located on the narrow side of the valve as well.

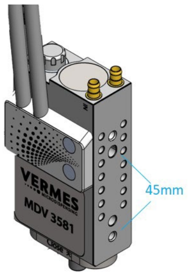


Fig. 21: Distance of the bores 45 mm

IMPORTANT NOTE

Corrosion

In order to prevent corrosion, all parts used in connection with the valve (screws, fixing plates etc.) should consist of stainless steel, nonferrous metals or galvanized steel.

6.3.3 Wiring of the MDS

The valve is connected to the control unit by means of a four-pin actuator plug (red) and five-pin sensor plug (yellow). The plugs are protected by coding against interchanging by mistake.

⚠ WARNING

Switch off before removing plug

Never attempt to attach or remove one of these plugs, when the system is connected to mains.

⚠ CAUTION

Plan your cable connections carefully

Make sure to plan your cable run carefully, when considering the wiring, especially if the valve is included into a more complex system. Your cables cannot hang too loose, since then they might start to swing and get damaged, because of the vibrations of the valve. On the other hand, you need enough length in your cables, if the valve is moved in the z-axis.

IMPORTANT NOTE

Switch off for disconnection

Before you disconnect the valve from the control unit or connect it to it, switch OFF the whole system.

6.3.3.1 Actuator Cable

Power to the piezo element is supplied by the actuator cable, which is wrapped with a red antikink sleeve. The voltage range is -50 V to 150 V (bipolar operation).

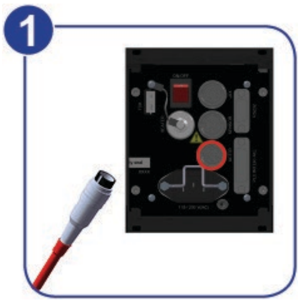


Fig. 22: Connecting the actuator cable – step 1

- Step 1: Plug the cable into the corresponding connector on the rear side of the control unit and screw it in place.

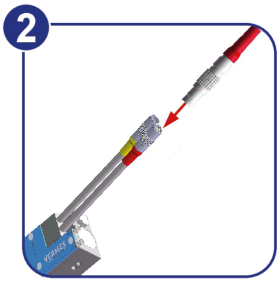


Fig. 23: Connecting the actuator cable – step 2

- Step 2: The other end, equipped with a four-pin LEMO connector (corrugated sleeve), has to be connected to the red marked, looped cable attached to the valve.

INFORMATION

Connecting cables

Verify during the connecting procedure that the red dots on the plugs point towards each other.

INFORMATION

Release latch for disconnection

To secure the connectors there is a latch, which you have to release before disconnection. You have to grip the corrugated outhousing. Pull back the outhousing of the male connector to release the latch (see Fig. 24). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

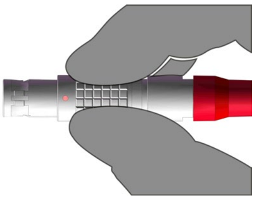


Fig. 24: Connector actuator cable - grip

6.3.3.2 Sensor Cable

This cable wrapped in yellow is provided to transfer data from the sensor integrated in the valve to the control unit. Connect it as described below.

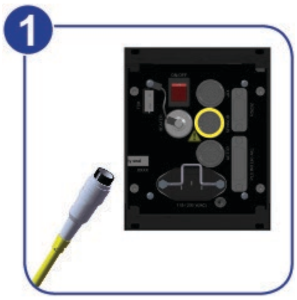


Fig. 25: Connecting the sensor cable – step 1

- Step 1: First, fix the sensor cable to the corresponding socket on the rear side of the control unit.

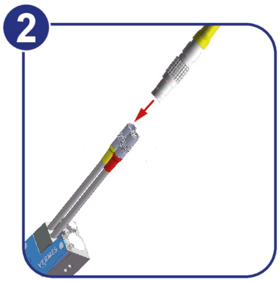


Fig. 26: Connecting the sensor cable – step 2

- Step 2: The five-pin connector with a corrugated sleeve has to be connected to the yellow marked, looped cable attached to the valve.

INFORMATION

Connecting cables

Verify during the connecting procedure that the red dots on the plugs point towards each other.

INFORMATION

Release latch for disconnection

To secure the connectors there is a latch, which you have to release before disconnection. You have to grip the corrugated outhousing. Pull back the outhousing of the male connector to release the latch (see Fig. 27, page 56). Then pull both connectors apart without losing the grip and they will separate.

Do not pull at the cables!

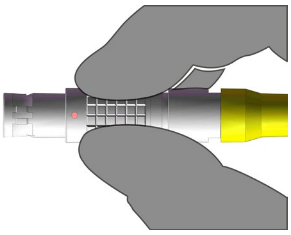


Fig. 27: Connector sensor cable - grip

6.3.3.3 Power Supply

Power to the control unit is supplied by the Switching Power Supply 48 V 4 A Push-Pull (order no. 1015251, see picture below).

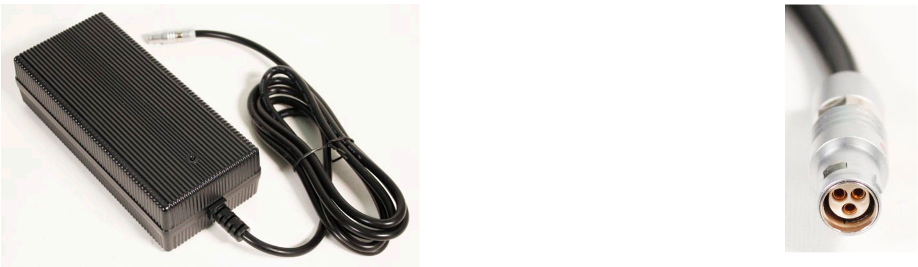


Fig. 28: Switching Power Supply 48 V 4 A Push-Pull and its connector

- Step 1: Plug the Push-Pull connector into the socket at the bottom of the rear side of the control unit. You can find the figure of the rear side in paragraph 4.3, page 23.
- Step 2: Connect the Switching Power Supply to the power supply.
- Step 3: Switch on the control unit by pressing the ON/OFF button on the rear side of the control unit to the position “ON”.

IMPORTANT NOTE

Valve not connected

If a valve is not connected when switch on the MDC, an error message (“101 wrong valve“) appears on the screen.

INFORMATION

MDC detects the heater and the cooler during start-up

During start-up, the MDC also checks if a heater and/or a flow control valve is connected. The messages “Heater connected!” (or “Heater is disconnected!”) and “Cooler connected!” (or “Cooler is disconnected!”) will be displayed. If the setting is selected, that a heater is automatically activated during start-up, you need to confirm it by pressing the [**enter**]-key, when a heater is connected.

6.3.3.4 Connecting a Heater

As an example. the heater MDH-48-BY (order no. 1014231, see Fig. 29, page 57) is shown to demonstrate the connection of a heater.

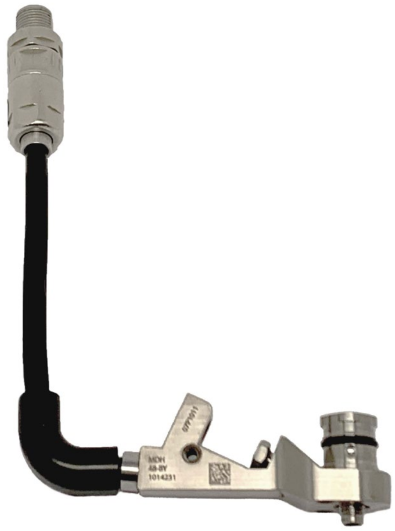


Fig. 29: Heater MDH-48-BY

The Heater Cable 48 V is available in different length (e.g. 2 m, order no. 1014064, see Fig. 30, page 57). To connect the connector of the heater to the rear side of the control unit (“Heater”), use the heater cable.

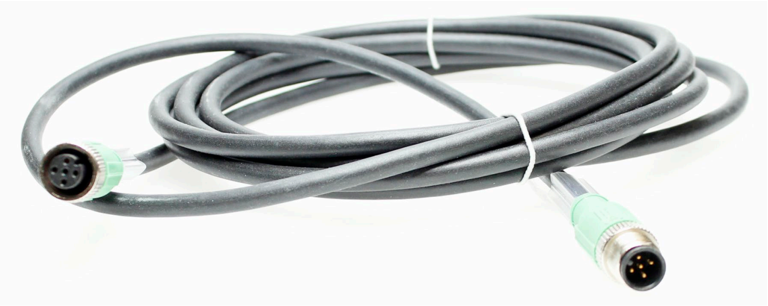


Fig. 30: Heater cable 48 V

6.3.3.5 Connecting a Cooler

As an example. the Flow Control Valve FCV-AC 6.0 M12 (order no. 1016265, see Fig. 31) is shown to demonstrate the connection of a cooler.

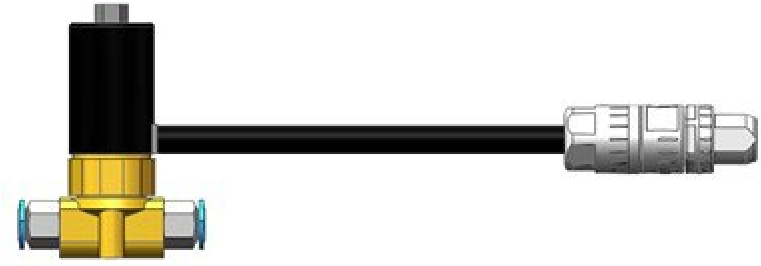


Fig. 31: Flow Control Valve FCV-AC 6.0 M12

To connect a cooler to the MDC, you need the Connection Cable for FCV-AC/HF M12 to MDC (length 2 m, order no. 1016252, see Fig. 32, page 58).

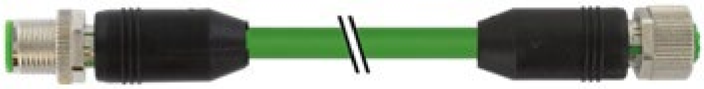


Fig. 32: Connection Cable for FCV-AC/HF M12 to MDC

With the connection cable, you can connect the cooler connector of the FCV-AC 6.0 M12 to the rear side of the control unit. Connect the air outlet of the flow control valve to the inlet of the microdispensing valve (marked with “IN”). Use a suitable hose. Connect the air inlet of the flow control valve to the compressed air supply.

6.3.3.6 Connection Diagram

The picture below offers an overview of how to connection all parts with cables and hoses (using one flow control valve and one heater as example).

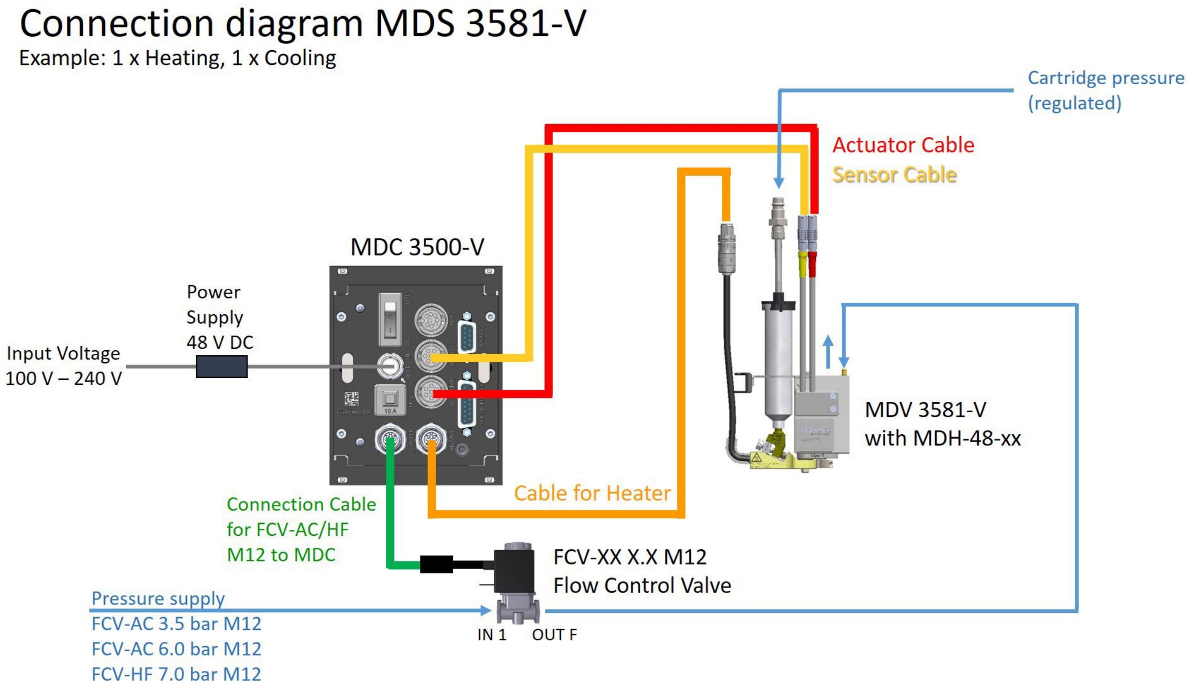

Connection diagram MDS 3581-V
Example: 1 x Heating, 1 x Cooling
Cartridge pressure (regulated)
Actuator Cable
Sensor Cable
MDC 3500-V
Power Supply 48 V DC
Input Voltage 100 V – 240 V
MDV 3581-V with MDH-48-xx
Cable for Heater
Connection Cable for FCV-AC/HF M12 to MDC
FCV-XX X.X M12 Flow Control Valve
Pressure supply
FCV-AC 3.5 bar M12
FCV-AC 6.0 bar M12
FCV-HF 7.0 bar M12
IN 1
OUT F

Fig. 33: Connection diagram of MDS 3581-V

6.4 Valves with Air cooling

If you want to air cool your valve with compressed air, you have to connect the air hoses after finishing the cable connections of the valve. Use 4 mm hoses.

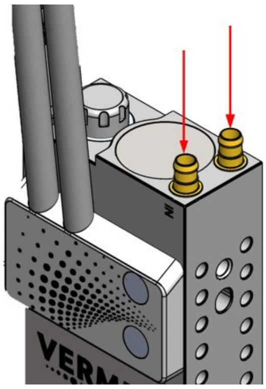


Fig. 34: Valve with air cooling connected

One end of the hose has to be pushed onto the air inlet of the valve (in); the other one is connected to the air supply.

The second connector (out) represents the outlet, evacuating the heated compressed air from the valve. You can extend this connection with an air hose. Push one end of the air hose onto the adapter. When running the hose to the air supply, take care not to impair functions of the system, or to disturb operators during their work.

For air cooling you should use a compressed-air pressure of about 2 bar. For a hot melt application or other high temperature applications, you should set the pressure higher, at up to 4 bar.

IMPORTANT NOTE

Quality of compressed air

Quality of compressed air should comply with DIN ISO 8573-1.

The pneumatic supply used for cooling of the valve should be free of fine dust and condensate, and correspond to classes 3, 4, 3 according to DIN/ISO 8573-1.

- Solid particles: Quality class 3

  max. number of particles/m^3: 0.5 – 1 µm: < 90000, 1 – 5 µm: < 1000
- Water content: Quality class 4

  max. pressure dew point +3 °C
- Residual oil: Quality class 3

  1 mg/m^3 max.

6.5 The Adjust Process

This chapter explains the adjust process, which is performed as a top adjust when using a valve of the MDV 358X Series, thanks to the adjust screw. A thoroughly performed adjust is the basis for clear and reproducible dispensing results.

The microdispensing system is unable to perform a regular repeatable process, if the nozzle insert is not properly positioned relatively to the tappet prior to dispensing. Therefore, you have to perform the adjust during initial operation and after each exchange of the nozzle fixation nut. This is especially important to avoid any leakage during dispensing.

Here, the adjust via keypad is described. You can also control the adjust via the serial interface as remote adjust (see paragraph 8.2.3 "Remote Adjust", page 132). For special applications you can set an adjust offset with service code 33 (see paragraph 7.12 "Adjust Offset", page 81).

IMPORTANT NOTE

Cleaning before adjust

The system has to be cleaned thoroughly before the adjust. The presence of dirt particles jammed between the tappet surface and the nozzle insert would compromise the results. For information how to remove the dirt read the cleaning chapter (see chapter 9, page 136).

IMPORTANT NOTE

Heating and adjust

In case your application uses a nozzle heater, you have to activate the heater before you start the adjust. Make sure to wait long enough for the heater to reach stable temperature, since the adjust could lead to an incorrect result otherwise.

While the heater is still heating up (red heater-LED is flashing), the message “Please wait for heating!” appears on the display. If necessary, you can start the Adjust ahead of time by pressing the [**esc**]-key during the heating phase, but you should be aware of the consequences for the accuracy of the Adjust.

Wear heat-resistant gloves while working with the valve!

INFORMATION

Time limit for the adjust

If you do not reach step 3 of the adjust after approx. two minutes, the adjust is cancelled. You have to start the adjust from the beginning.

Preparation for the adjust:

- Screw the nozzle fixation nut absolutely tight (see Fig. 35; torque for screwing it tight at least 150 cN.m).

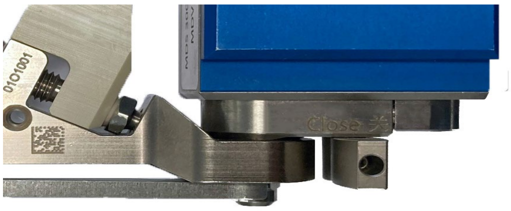


Fig. 35: Screwing tight the nozzle fixation nut

Adjust, step 1 (Starting the adjust):

- Press the **[ADJ]**-key on the keypad of the control unit.

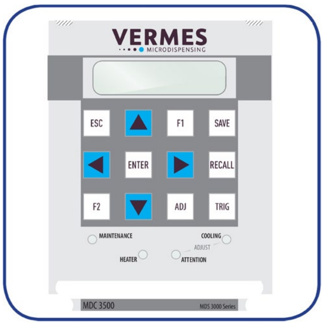
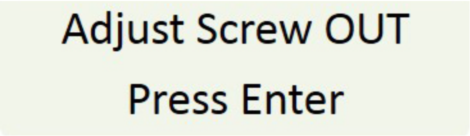


Fig. 36: Adjust – Press [ADJ]

The display shows the following message:



Adjust Screw OUT

Press Enter

Fig. 37: Message Adjust Screw OUT

- Screw open the adjust screw completely (see Fig. 38; torque for screwing it open approx. 50 – 60 cN.m).

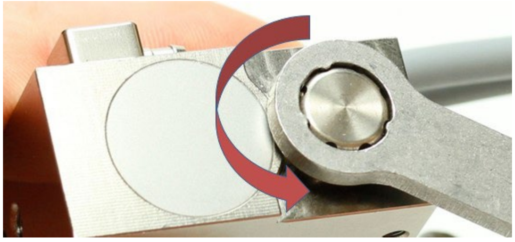


Fig. 38: Screw open adjust screw

- Afterwards press the **[ENTER]**-key.

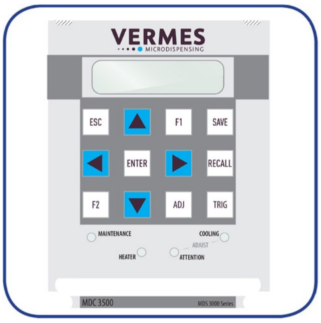
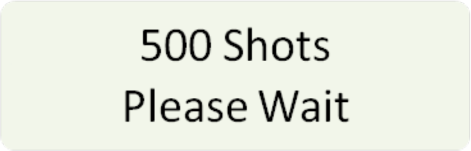


Fig. 39: Adjust – Press [ENTER]

The display shows the message “500 Shots – Please Wait”. These shots help to prepare the valve for the adjust.



500 Shots
Please Wait

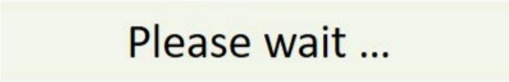
Fig. 40: Message 500 Shots – Please Wait

INFORMATION

Adjust offset during 500 shots

In case you have an adjust offset activated, when you start the adjust, both adjust LEDs will blink during the 500 shots. At the same time, the adjust offset value is shown in the display.

A few seconds later, the display shows the message “Please wait …”.



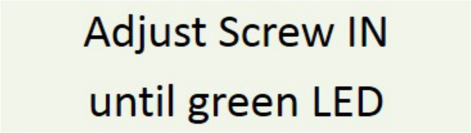
Please wait ...

Fig. 41: Message Please wait …

Wait until a new message on the display announces the next step.

Adjust, step 2 (Turn in adjust screw):

The screen shows the message “Adjust Screw IN until green LED”.



Adjust Screw IN
until green LED

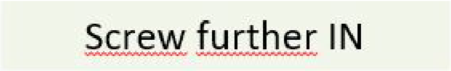
Fig. 42: Message Adjust Screw IN – until green LED

INFORMATION

Support information for older valves

In exceptional cases, older valves may display the message “Please contact the support!” at this point. In this case, please contact the technical support of VERMES Microdispensing (see Page 7). They will explain how to proceed with this valve.

After one second, the initial message disappears from the display. Instead, the message “Screw further IN” appears.



Screw further IN

Fig. 43: Message Screw further IN

– Screw the adjust screw carefully clockwise. While screwing, you will see an increasing amount of arrows shown in the display (see Fig. 44).

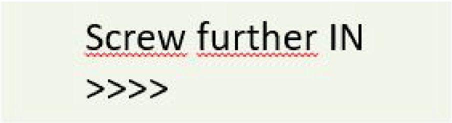

Screw further IN
>>>>

Fig. 44: Arrows displayed

Adjust, step 3 (Find adjust point and confirm it):

- Keep turning the adjust screw slowly clockwise, until the display shows “press enter - 0”. Meanwhile, the green adjust LED is ON (see Fig. 45).

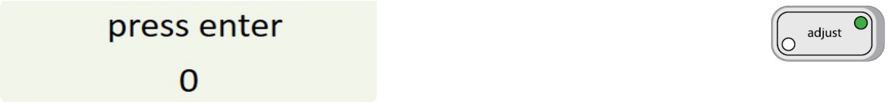

press enter
0

Fig. 45: Message press enter – 0, the green adjust LED is ON

- Confirm the adjust with pressing **[ENTER]**. The adjust is finished successfully and you are send back to the main menu.

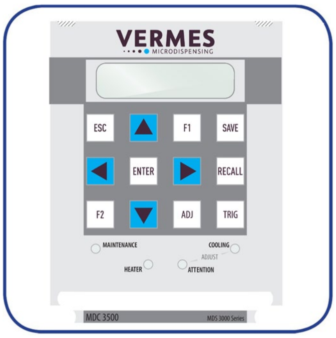


Fig. 46: Adjust – Press Enter

In case you had turned the adjust screw too far, the display shows “Adjust Screw OUT – X <<<<”. Also, the red adjust LED is ON instead of the green one (see Fig. 47).

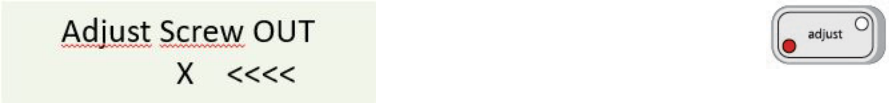

Adjust Screw OUT
X <<<<

Fig. 47: Message Adjust Screw OUT – X <<<<, the red adjust LED is ON

- Unscrew the adjust screw (counter-clockwise) until the green adjust LED is ON. From there, screw further back, until both LEDs are OFF. Then screw back in, until the display shows “press enter! - 0” and the green adjust LED is ON.
- Press the **[ENTER]**-key.

IMPORTANT NOTE

Do not screw too far

Do not keep screwing the adjust screw further clockwise, if the red adjust LED is ON. Otherwise the tappet or the nozzle insert could get damaged.

INFORMATION

Confirming adjust

A correctly completed adjust can only be confirmed with **[ENTER]**, while the green adjust LED is ON.

INFORMATION

Abort and end of procedure

- The adjust can be aborted any time by pressing **[ESC]**. The display changes back to the main menu.
- After the adjust the green lamp dims within approx. 3 s.

6.6 Initial Liquid Supply

- Step 1: If not using a prefilled cartridge, fill an empty one with the required fluid, till up to 80 % of its capacity.
- Step 2: Insert the cartridge into the corresponding holder and screw it onto the Luer-Lock connector, rotating clockwise.
- Step 3: Place the compressed-air adaptor onto the cartridge and rotate clockwise until it latches in place.
- Step 4: Connect the PVC hose with coupler plug KS4-CK-6 to air supply. A coupler socket type KD4-1/2-A is required.
- Step 5: After establishing a convenient dispensing pressure, activate the pneumatic supply.

IMPORTANT NOTE

Check for leakage

All of the parts must be installed correctly, and the entire configuration must be leak-tight – otherwise the dispensing fluid can trickle out in an uncontrolled manner.

Valves designed by VERMES Microdispensing can be operated at a relatively low supply pressure, in the range between 0 bar and 7 bar. This upper limit should not be exceeded in normal applications; in most cases, even a value of 4 bar is sufficient.

Standard values:

- Low-viscous fluids (e.g. water): 0.5 – 1.5 bar
- Medium viscosity (e.g. SMT-adhesives): 1.5 – 2.0 bar
- High viscosity (e.g. pastes): 2.0 – 7.0 bar

IMPORTANT NOTE

Do not activate system without dispensing medium

Except for the adjust, do not activate the system “dry” (i.e. without dispensing medium). Otherwise, it might damage the system. For flushing the valve keep within the following limits:

- Needle Lift max. 80
- Falling min. 0.13

6.7 Removing Air Inclusions from the Fluid Box

Air must be removed from the fluid box, for instance after the exchange of a cartridge.

Save the current dispensing parameters beforehand (see paragraph 7.6, page 71).

Confirm the following parameter selection:

Rising 0.5, Open Time 1.5, Falling 0.17, Delay 5–30, Needle Lift 75, Number of Pulses 500–2000

Dispense a quantity of ca. 500 to 2000 shots by pressing **[trig]**.

When this measure is complete, retrieve the initial parameters stored beforehand (see paragraph 7.7, page 71) and start the dispensing process.

6.8 Parameter Input and Start

- Step 1: Enter the dispensing parameters (either recommended by the manufacturer or determined in your own experiments) into the submenu "Pulse Parameters" of the control unit (see paragraph 4.5.2, page 29).
- Step 2: Press **[enter]** to acknowledge the selection.
- Step 3: Return to the first level of the menu by pressing **[esc]** repeatedly.
- Step 4: Start the dispensing process by pressing **[trig]**.

INFORMATION

Starting the dispensing process

A dispensing process can only be initiated in the first menu level by all the usual methods. Starting it in the other menu levels is only possible with the key **[trig]**.

7 Operation

7.1 Triggering a Dispense Sequence

There are three different options to trigger a dispense sequence:

- **via keypad on the control unit MDC**

  Press the **[trig]** button, a dispensing sequence with pre-set parameters will be triggered.
- **via RS-232C command**

  Use the command “VALVE:OPEN” (further commands in paragraph 8.1.2, page 90).
- **via PLC-signal**

  Real time triggering by direct I/O (recommended length of signal: between 0.0001 ms and 35 ms; not relevant for Infinite Mode and External Mode)

7.2 Dispensing and Positioning of Dots (Modes)

To combine a multitude of dots to a predefined structure (e.g. a line or a circle), use one of the following modes:

- Burst Mode

  A single trigger impulse by PLC signal causes a predefined number of dispense cycles.

  Number of Pulses: predefined value (e.g. 1–32000)
- Single-Shot Mode

  Each dispense point is triggered by an individual PLC signal. When dispensing a continuous feature (such as a straight line or a circle), the frequency of the dispense trigger signal should be proportional to the trajectory speed of the axis system. This is necessary to achieve a continuous line width.

  Number of Pulses: “1”
- Infinite Mode

– Continuous dispensing as long as the PLC trigger input is “logic 1”. Dispensing will stop when the signal is changed to “logic 0”

– Number of Pulses:

– “infinite” (when programmed through keypad)

– “0” (when programmed through RS-232C)

The parameters Rising, Falling, Delay, Needle Lift and Open Time use the values preset in the menu. Is the PLC trigger signal “logic 1”, the MDC sends dispensing impulses, until the signal changes to “logic 0”.

- Scenario Mode

  A complex set of shots is defined via a scenario. This allows the dispensing even of very complex structures, since up to ten different segments, each with their own set of parameters, can be combined. Four different scenarios can be saved.

  The parameters are set according to the specifications of the scenarios.
- External Mode

  The “External Mode” will shift the responsibility of time control of the parameter “Open Time” to the higher-level machine control. (This may require a very precise time control of the higher level PLC.) As a result, the valve would function like a “Time-Pressure-Valve”.

  Activation of the control unit via RS-232C command by changing the pulse parameters. For the External Mode set the Open Time to “external”.

  Number of Pulses: Should be set to “1” (min delay still applies).

  Open Time calculates according to: Length trigger impulse – length Rising = length Open Time

The parameters Rising, Falling and Needle Lift use the values preset in the menu. When the trigger signal is set to "logic 1", the valve will open. It will remain open as long as the trigger signal remains on "logic 1". It will start to close when the trigger signal is switched to "logic 0". After the valve has completely closed, the controller is ready to receive the next trigger signal to start the process again.

INFORMATION

Open Time and Needle Lift

The maximum value for the "Open Time" is limited to 15 ms, if the "Needle Lift" is set to more than 80 %. If not, the limit is 3000 ms. The length of the "Open Time" depends on the PLC-signal (logic 1).

7.3 Parameters for the Dispensing Process

The profile of the system behavior is illustrated below (Y axis = amplitude of the tappet).

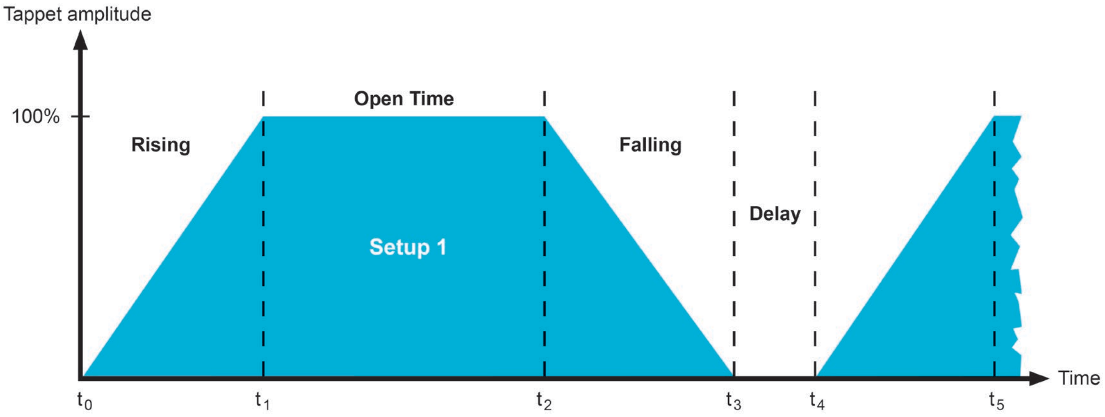


Fig. 48: System behavior

This diagram includes the following parameters.

Parameter	Unit	Description
Rising (RI)	**0.01 ms**	This interval describes the time required until the valve is completely opened. It is adjustable in steps of 0.01 ms.
Open Time (OT)	**0.1 ms**	During this phase, the valve remains in opened state. It is adjustable in steps of 0.1 ms. Max. open time = 3000 ms **Information!** In special applications, you can set the Needle Lift to up to 115 %. But at a NL > 100 %, the Open Time is limited to 15 ms. **Caution!** When working in External mode, the cycle is initiated with following properties: For rising, falling, delay and needle lift, the values determined beforehand are used. Open time however remains active until the signal returns to the state "logic 0".

Falling (FA)	**0.01 ms**	The falling ramp of the curve illustrated above represents the time required for closing the valve. Residual fluid meanwhile is expulsed from the nozzle compression chamber (the cavity at the rear end of the nozzle insert). The interval is adjustable in steps of 0.01 ms.
Delay (DL)	**0.1 ms**	This waiting phase between two cycles is adjustable in steps of 0.1 ms, but it is recommended to use at least 0.2 ms.
Needle Lift (NL)	**%**	This parameter describes the stroke of the tappet, compared to its full value of 100 %. **Information!** In special applications, you can set the Needle Lift to up to 115 %. But with a NL > 100 % (in the bipolar mode), the Open Time is limited to 15 ms, since such a high Needle Lift has a stronger wear on the piezo because of the extra heat it causes. A Needle Lift between 70 % and 80 % is the best working range.

Tab. 20: Parameters for dispensing

7.4 Minimum and Maximum Parameter Limits

Parameters	Min. Value	Max. Value	Transform. Factor (serial interface)
Rising	NL 1 % = RI 0.01 ms NL 10 % = RI 0.03 ms NL 20 % = RI 0.06 ms NL 30 % = RI 0.09 ms NL 40 % = RI 0.12 ms NL 50 % = RI 0.15 ms NL 60 % = RI 0.18 ms NL 70 % = RI 0.21 ms NL 80 % = RI 0.24 ms NL 90 % = RI 0.27 ms NL 100 % = RI 0.30 ms	300 ms	*100 e.g. RI = 0.05 ms ≙ 5
Falling	NL 1 % = FA 0.01 ms NL 10 % = FA 0.01 ms NL 20 % = FA 0.02 ms NL 30 % = FA 0.03 ms NL 40 % = FA 0.04 ms NL 50 % = FA 0.05 ms NL 60 % = FA 0.06 ms NL 70 % = FA 0.07 ms NL 80 % = FA 0.08 ms NL 90 % = FA 0.09 ms NL 100 % = FA 0.10 ms	300 ms	*100 e.g. FA = 0.08 ms ≙ 8
Open Time	0 ms	3000 ms (NL>100 %: 15 ms)	*10 e.g. OT = 2 ms ≙ 20
Needle Lift	1 %	100 % (115 % in special applications)	*1 e.g. NL = 50 % ≙ 50
Number of Pulses (NP)	1 pulse	32000 pulses	*1 e.g. NP = 80 ≙ 80
Delay	0.1 ms	1000 ms	*10 e.g. DL = 5 ms ≙ 50
Heater	Target temperature	Depends on the connected heater (a maximum of 300 °C can be set)	*1

Tab. 21: Minimum and maximum parameter limits

7.5 Input of Values

Modification of parameter values is simple. The name of the parameter appears in the upper, the assigned numerical value in the lower line of the screen. If the last digit before the decimal point is flashing, you can modify the value.

- Increase by one by using the **[↑]**-key.
- Correspondingly, the **[↓]**-key reduces the value by one.
- The **[→]**-key shifts the position of the active digit to the right.
- To shift the active position to the left, use the **[←]**-key.

Selection of other values (no numerical values) is performed similarly.

- Use the **[→]**-key or the **[←]**-key to change between ON and OFF.
- An input must be confirmed by [enter], to save the current selection. Then the control returns to the next-higher menu point.
- To cancel without saving the current selection, press **[esc]**. The screen returns to the next-higher menu level.

INFORMATION

Changing numbers

When modifying the first digit of a value from “1” to “0”, the cursor automatically jumps one position to the right (if possible). The value in this position is set to 5, but you can modify it.

7.6 Saving Parameter Sets

Ten storage locations are available to save the pulse parameters from the menu.

– Step 1: Open the storage menu by pressing **[save]**.
– Step 2: Select the desired storage location with the arrow keys.
– Step 3: Confirm the selection by pressing **[enter]**.

INFORMATION

[esc] to abort

Pressing **[esc]** causes the saving procedure to be aborted. You can also use the submenu “Pulse Parameters” (see paragraph 4.5.2, page 29) to save parameters.

7.7 Retrieving Parameter Sets

Parameter combinations saved in the system can be recalled any time.

– Step 1: Press **[recall]** to activate the corresponding function.
– Step 2: Select the desired storage location with the arrow keys.
– Step 3: Confirm the selection by pressing **[enter]**.

INFORMATION

[esc] for interrupt

[esc] interrupts the procedure at once.

7.8 Select Pins

Setups can be directly controlled via the select pins of the AUX socket (see Fig. 49), if “Scenario” in the submenu “Scenario” is turned “OFF”. (In case “Scenario” is “ON” and you want to work with the scenarios, please refer to paragraph 7.9.3, page 75.) The select pins allow you to switch in real time between the setups 0 to 3.

INFORMATION

Setup 0 = working configuration

Please be aware that setup 0 is the working configuration and therefore is not programmed additionally.

With the pins Select_I (AUX socket Pin 5) and Select_II (AUX socket Pin 8) it is possible to switch rapidly between different sets of parameters. In their **blank state**, the select pins are on a high level (pull-ups to 24 V). You have to switch them to low (Gnd) to select a different setup (see Fig. 51, page 73 and see Tab. 22, page 73). For additional information regarding the AUX socket, see paragraph 8.3, page 135. You have to switch them before triggering.

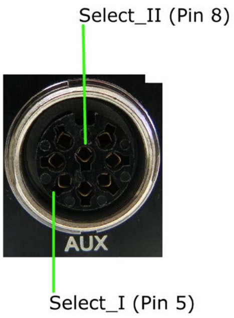


Fig. 49: Select Pins

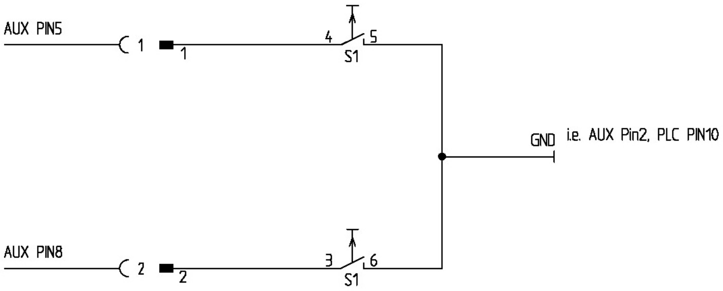


Fig. 50: Schematic of usage of select pins, example

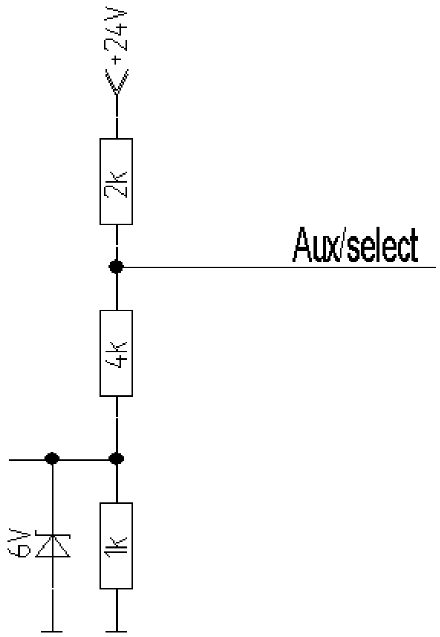


Fig. 51: Circuit diagram

INFORMATION

Select pins with other commands

Select pins will be checked for triggering via PLC interface, for the serial commands VALVE:AOPEN and SVALVE:AOPEN (in the versions without parameters) and when pressing the [**trig**]-key.

Setup	Select_II (Pin 8)	Select_I (Pin 5)
Setup 0	High	High
Setup 1	Low	High
Setup 2	High	Low
Setup 3	Low	Low

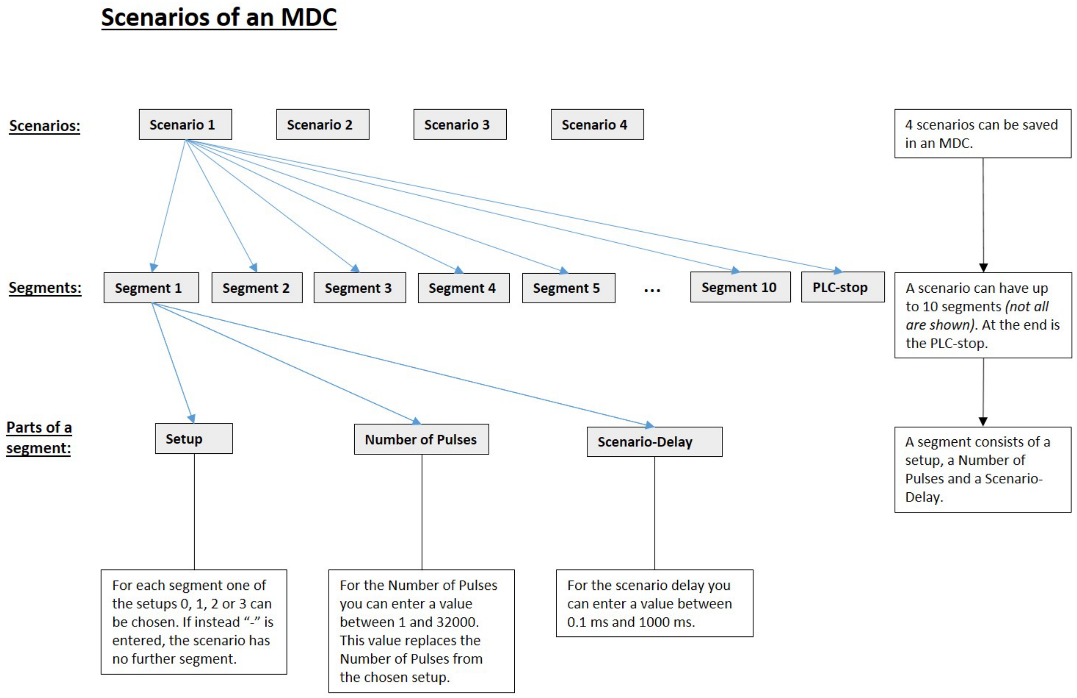
Tab. 22: Select Pin settings for the setups

7.9 Scenarios

The MDC does not only allow you to save setups of parameters, but also to define combinations of setups, so called scenarios.

7.9.1 Basics about Scenarios

Each scenario consists of up to ten segments, each with a setup, a specific scenario delay and a Number of Pulses (see Fig. 52). You can define up to four scenarios. You can only choose between the setups 0, 1, 2 and 3. A maximum of ten segments can be chained together, consisting of any possible combination of the four potential setups 0, 1, 2 and 3. As soon as you enter "-" when selecting a segment, the chain ends. No further segments will be shown in the menu. This is possible even for the first segment you select. In that case, the working configuration (setup 0) would be executed instead of the scenario.



4 scenarios can be saved in an MDC.

A scenario can have up to 10 segments *(not all are shown)*. At the end is the PLC-stop.

A segment consists of a setup, a Number of Pulses and a Scenario-Delay.

For each segment one of the setups 0, 1, 2 or 3 can be chosen. If instead "-" is entered, the scenario has no further segment.

For the Number of Pulses you can enter a value between 1 and 32000. This value replaces the Number of Pulses from the chosen setup.

For the scenario delay you can enter a value between 0.1 ms and 1000 ms.

Fig. 52: Scenarios of an MDC

For each segment in a scenario, you can enter a Number of Pulses. For this segment, the number then replaces the Number of Pulses saved with the original setup. The value can be between 1 and 32,000 or "infinite". With "infinite", the trigger signal defines the end.

The scenario delay marks the time span between two segments. It can be set in the range of 0.1 ms and 1000 ms.

Each scenario has a scenario PLC-stop, which is either "ON" or "OFF". If it is "ON", you can end the scenario prematurely. The moment the trigger switches to "low", the scenario ends. When it is "OFF", the trigger only affects a segment on "infinite" number of pulses. In that case, once the trigger is switched to "low", the system moves on to the scenario delay, followed by any segments still to come. Unlike the "ON" situation, the scenario does not end immediately.

Scenarios can be controlled in two ways:

- via keypad (see next part)

- with remote commands via the serial interface RS-232C (see paragraph 8.1.2, page 90)

Scenarios can also be controlled directly via select pins (see paragraph 7.8, page 72). You have to set item “Scenario” of the submenu “Scenario” to “ON“. While this is the case, the display shows “Scenario” where it usually shows the frequency.

7.9.2 Entering Scenarios

To enter the parameters for a scenario you have to go to the submenu “Scenario” (see paragraph 4.5.5, page 35). To do so, you have to press **[enter]** in the main menu and then **[←]** twice. Confirm with **[enter]** to reach the item “Scenario”. Press **[enter]** and use either **[↑]** or **[↓]** to switch between “ON” and “OFF”. Select “ON” and confirm your choice with **[enter]**.

Now you can select the desired scenario with **[→]** (see paragraph 4.5.5, page 35, the diagram for the submenu “Scenario-Def”). Press **[enter]**. Enter the first setup (“0”, “1”, “2”, “3” or “-”) and confirm with **[enter]**. With **[→]** you reach “ScNP”, where you can enter the Number of Pulses. For the scenario, this value will replace the one saved within the setup. Values can be between 1 and 32,000 or “infinite”. Confirm with **[enter]**. With another **[→]** you reach “ScDL”, where you can set the scenario delay. Afterwards confirm with **[enter]**.

Repeat with the second segment, and so on, until you have entered all segments you need or until you reached the maximum of ten defined segments. When you want to end the chain, enter “-” instead of the number of a setup. No further segment will be shown in the menu. If you replace a “-” on a given segment with a correct number, it is unlocked. The system starts with the setup NP and 10 ms as Scenario-Delay, but you can change these values individually.

With **[→]** after the last segment you reach “PLCStop” (Scenario-PLC-Stop). After pressing **[enter]** you can switch between “ON” and “OFF” (using any arrow key). Confirm your choice with **[enter]**. (If PLCStop is your only goal in this submenu, it is faster to click **[←]** once on this level. Like all other menus, this is “wrap-around”.)

This process you have to repeat for each of the up to four scenarios you want to define.

Scenarios are started with a trigger event. This can be a trigger via keypad, a PLC interrupt or the “Valve Open” command (without parameters) via the serial interface.

INFORMATION

When no scenario is triggered

Valve-Up/-Down via serial interface and the **[F1]** key cannot trigger a scenario.

7.9.3 Scenario Selection with Select Pins

Scenarios can be directly controlled via the select pins of the AUX socket (see Fig. 53, page 76), if “Scenario” in the submenu “Scenario” is turned “ON”. If that is not the case, they switch between the setups 0 to 3 instead.

With the pins Select_I (AUX socket Pin 5) and Select_II (AUX socket Pin 8) it is possible to switch rapidly between different sets of parameters. In their blank state, the select pins are on a high level (pull-ups to 24 V). You have to switch one or both to low (Gnd) to select a different setup (see Tab. 23, page 76). You have to switch them before triggering.

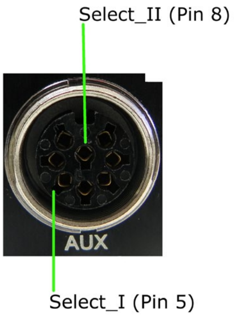


Fig. 53: Select Pins

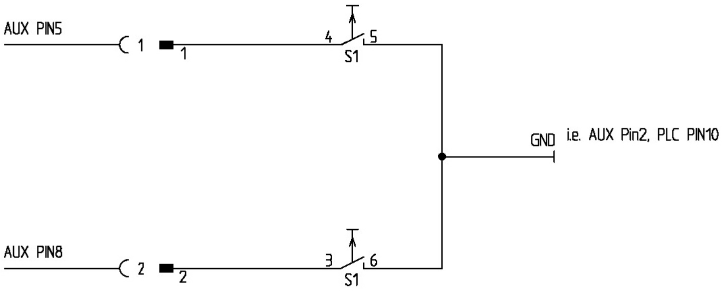


Fig. 54: Schematic of usage of select pins

INFORMATION

Select pins with other commands

Select pins will be checked for triggering via PLC interface, for the serial commands VALVE:AOPEN and SVALVE:AOPEN (in the versions without parameters) and when pressing the key **[trig]**.

You can also simulate the select pin settings for these two commands by using the command extensions “S0”, “S1”, “S2” or “S3” (see paragraph 8.1.2.3 "Explanations", page 95).

Parameters	Select1	Select2	Scenario „OFF“	Scenario „ON“
S0	High	High	Setup 0 (working configuration)	Scenario 1
S1	Low	High	Setup 1	Scenario 2
S2	High	Low	Setup 2	Scenario 3
S3	Low	Low	Setup 3	Scenario 4

Tab. 23: Select Pin settings

7.9.4 Multi Dot Mode

The Multi Dot Mode allows you to dispense with scenarios on repeat (for information on scenarios, see paragraph 7.9, page 74).

To activate the Multi Dot Mode, you have two options (default is OFF):

- Use service code 4000 to activate/deactive it (see paragraph 4.5.6, page 37).
- Use the serial command SYSTEM:MULTIDOT:ON (and SYSTEM:MULTIDOT:OFF to deactivate it, see paragraph 8.1.2.3, page 95).

INFORMATION

Scenario Mode must be ON

To use the Multi Dot Mode, Scenario Mode must be activated as well. Also make sure you have entered the parameters of the active scenario, i.e. the scenario you want to use. If you deactivate the Scenario Mode, the Multi Dot Mode is switched OFF as well.

In the Multi Dot Mode, you start the active scenario (usually scenario 1) with a trigger and it will be repeated as long as the trigger is active (“high”; for an example with activated Multi Dot Mode see Fig. 55 and with deactivated Multi Dot Mode see Fig. 56). Parameter limits are the same as usual in Scenario Mode.

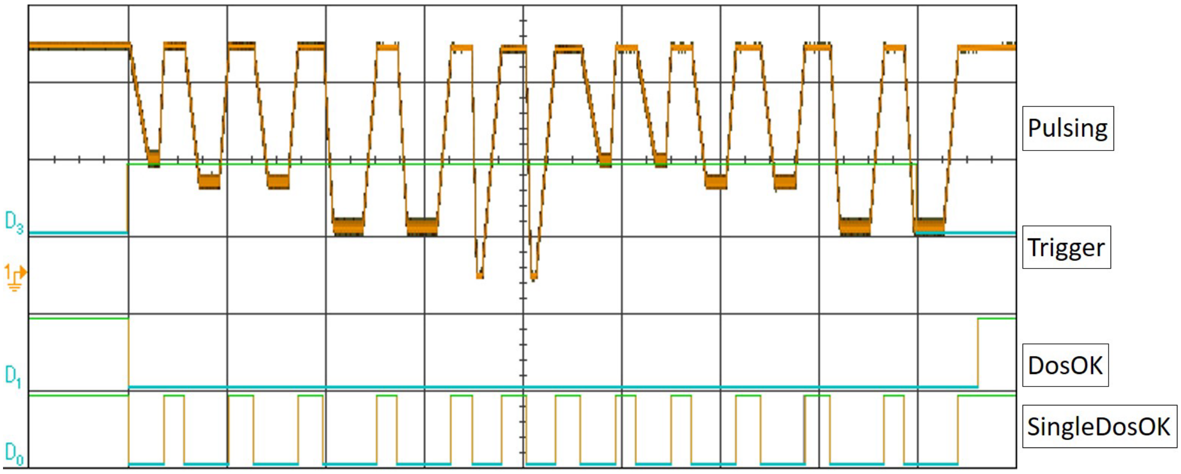


Fig. 55: Multi Dot Mode ON

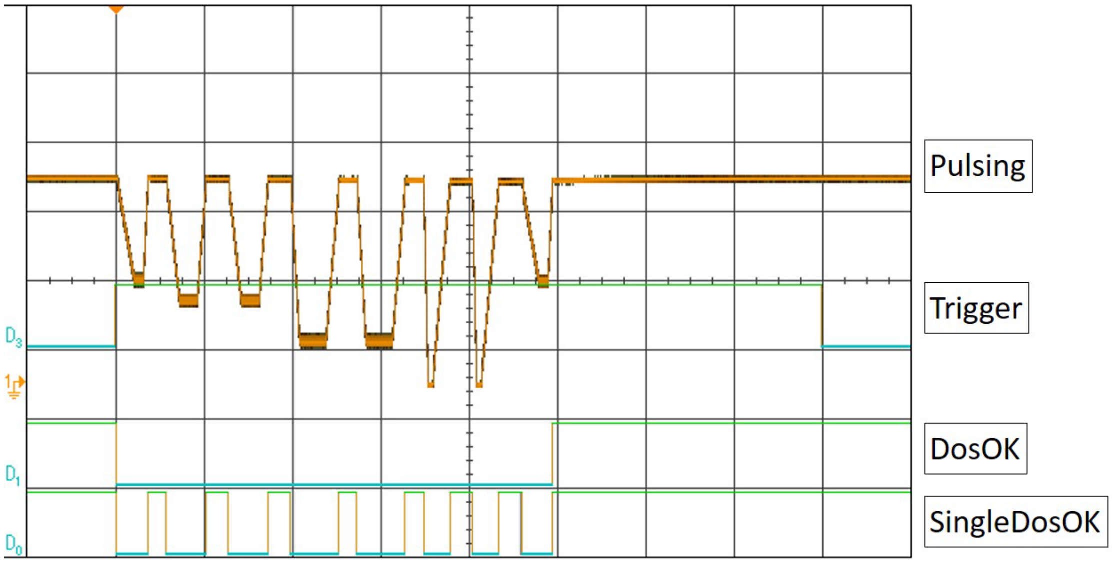


Fig. 56: Multi Dot Mode OFF

When you end the trigger (signal back to low), there are two options how the dispensing ends, depending on the setting of the PLC-Stop. If PLC-Stop is ON, the valve stops immediately after the current shot (see Fig. 57, page 78).

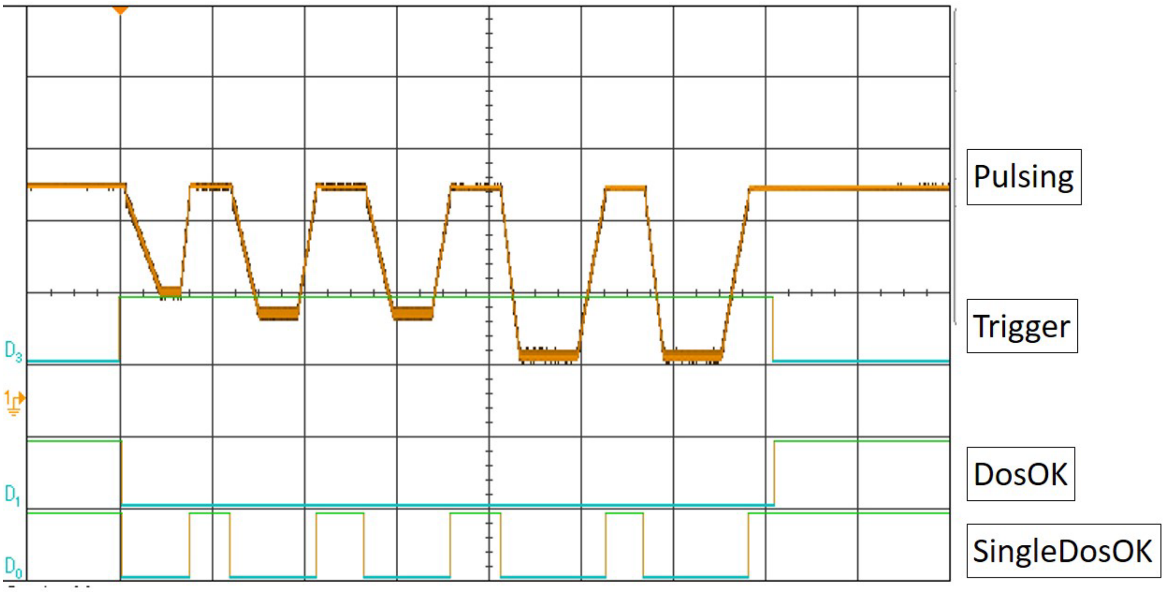


Fig. 57: Multi Dot dispensing – PLC-Stop ON

If the PLC-Stop is OFF, the current setup within the scenario is finished, before dispensing stops (see Fig. 58).

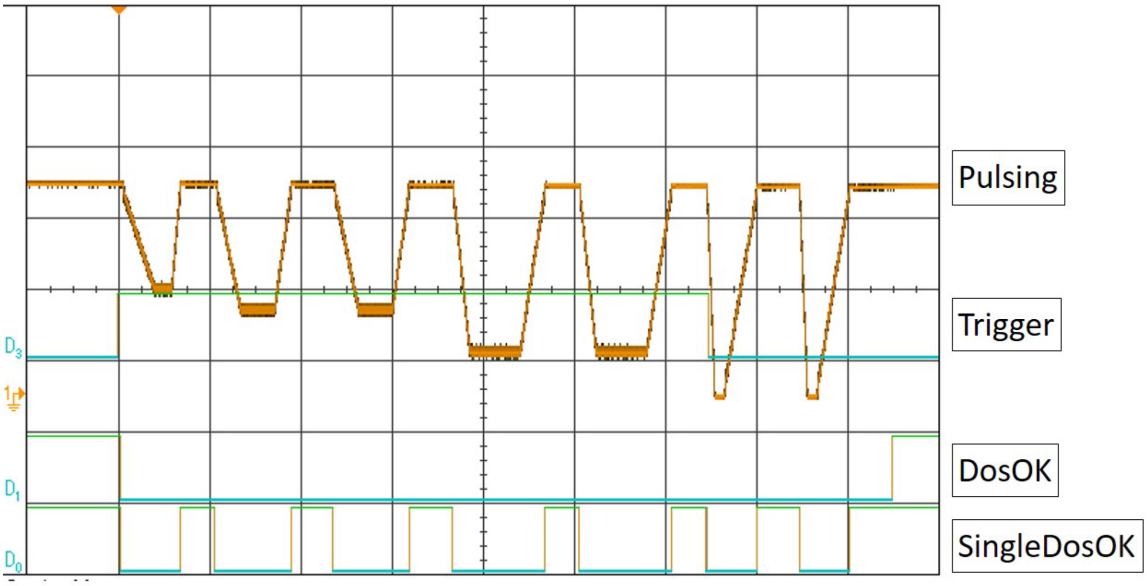


Fig. 58: Multi Dot dispensing – PLC-Stop OFF

To check the status of the Multi Dot Mode, use the serial command SYSTEM:SHOW:STATUS (see paragraph 8.1.2.3, page 95).

7.10 Factory Settings

By recalling the factory settings (implemented by the manufacturer), you return to a predefined starting position. This is useful to start the input of a new parameter set.

These are the values contained in the factory settings:

RI = 0.50 ms, FA = 0.20 ms, OT = 2.0 ms, NL = 80 %, DL = 10.0 ms and NP = 1.

- Step 1: Press **[recall]**.
- Step 2: **[↓]** immediately opens this parameter set.
- Step 3: Confirm the selection with **[enter]**.

INFORMATION

Aborting the process

The working configuration (setup 0) is changed to the factory settings. Press **[esc]** to abort at any time.

The following table lists the factory settings of the setups.

	RI [ms]	OT [ms]	FA [ms]	NL [%]	NP	DL [ms]
Setup 0	0.50	2.0	0.20	80	1	10.0
Setup 1	1.00	4.0	0.12	80	1	10.0
Setup 2	0.50	2.0	0.20	80	10	10.0
Setup 3	0.40	0.6	0.16	80	1	10.0

Tab. 24: Factory settings of the setups

With Setup ALL (see paragraph 4.5.6 "Submenu “Service-Option”", page 37), Setup 4 – 10 get the same values as setup 0 (working configuration).

The factory settings for all four scenarios are the same. The PLCStop is “OFF”, the other parameters are shown in the following table.

Sc.-Segment	Setup used	ScNP	Sc.-Delay
Segment 1	0	as setup NP	10.0 ms
Segment 2	1	as setup NP	10.0 ms
Segment 3	2	as setup NP	10.0 ms
Segment 4	3	as setup NP	10.0 ms
Segment 5	0	as setup NP	10.0 ms
Segment 6	1	as setup NP	10.0 ms
Segment 7	2	as setup NP	10.0 ms
Segment 8	3	as setup NP	10.0 ms
Segment 9	0	as setup NP	10.0 ms
Segment 10	1	as setup NP	10.0 ms

Tab. 25: Factory settings of the scenarios

You can use the menu to reset changed parameters to their factory settings. Go to the submenu “Service-Option” and press **[enter]** at “Service Code“. You can enter the four-digit service code 1000. Confirm it with **[enter]**. Now you can use the keys **[←]** or **[→]** to choose between four options. You can either reset the setups 0 – 3, all setups, all scenarios or every parameter (“Reset

ALL", will also turn OFF the heater). You can move through the four options with the keys **[↑]** and **[↓]**. Confirm your choice with **[enter]** and confirm the whole process with another **[enter]**.

7.11 Auxiliary Mode

In this mode, you cannot dispense, since there is no internal communication with the valve. The valve might even be disconnected. But you can use most of the other functions of the MDC, e.g. check your parameters. While in auxiliary mode, the display shows the message "Auxiliary Mode" in the bottom line. Auxiliary mode is automatically deactivated when you switch off the MDC.

INFORMATION

Some menu items not shown in auxiliary mode

Some menu items are not shown, while the system is in auxiliary mode (the menu items "Tappet" and "Nozzle" in the main menu, the submenu "Cooler/Heater", and the menu items "Reset Nozzle", "Reset Tappet", "Set Nozzle" and "Set Tappet" in the submenu "Status").

You can enter the auxiliary mode through the menu. You have to enter service code "1000" in the submenu "Service Code" which is part of the menu "Service Option" (see paragraph 4.5.6, page 37).

After the error messages 101 (Incorr. Valve) and 199 (Valve Error), you also get the chance to switch to the auxiliary mode. This allows you to keep control of the information and most of the functions of the MDC in such a situation (see chapter 11, page 156).

7.12 Adjust Offset

If you have a problem with leakage despite a correct adjust (see paragraph 6.5, page 60), you can use service code 33 to add a little adjust offset. This adjust offset will make sure the valve is accordingly tighter than indicated by the display value. E.g. with an adjust offset of -4, the adjust still works at 0 %, but the valve is tighter at this value than it would be without the adjust offset.

To enter a service code, go to “Main Menu -> Service-Option -> Service Code” (see also the figure below and paragraph 4.5.6, page 37), press **[enter]** and enter 33. Once you have confirmed the service code with **[enter]**, you reach a new submenu called “Adjust Offset”. There you can enter a value between -5 and 10 (negative means tighter than normal, positive looser than normal). Confirm your value with [**enter**]. If you set an adjust offset of 0, the adjust offset is deactivated. It is advisable to test the system first with an adjust offset value near the default value of 0, e.g. -1

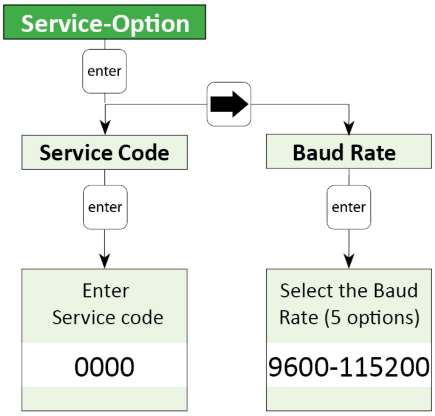


Fig. 59: Submenu Service-Option

Alternatively, you can use the serial command ADJUST:OFFSET:<value>, to set an adjust offset (see paragraph 8.1.2.3, page 95). The range is the same as if you set it via the keypad. You can also use the command ADJUST:OFFSET:? to check for an existing adjust offset.

It is important to know that this adjust offset value is only saved in the valve. You have to enter it again, if you change the valve. But as long as you use the same valve, you can switch off the control unit and the adjust offset value is kept.

INFORMATION

Adjust offset activated during adjust

In case you have an adjust offset activated, when you start the adjust, both adjust LEDs will blink in synchronocity during the 500 shots. At the same time, the adjust offset value is shown in the display.

7.13 Dispensing with a Heater

The Microdispensing System MDS 3581-V can optionally be equipped with a nozzle heater. One option is the MDH-48-BY (see Fig. 60). If a heater is connected to the system, the main menu shows the current temperature (in °C) instead of "Ready". More detailed information about the menu, while using a heater, you can find in paragraph 4.5.3.2, page 31 and paragraph 7.13.1, page 83.

IMPORTANT NOTE

Cartridge heater not compatible

Currently, only nozzle heaters are compatible with the MDC 3500-V. If you want to use a cartridge heater, e.g. the MCH30-48 Cartridge Heater, you need an external heater controller. We recommend the MFC 3000 (order no. 1014981) or the MHC 48-2 (order no. 1015680).

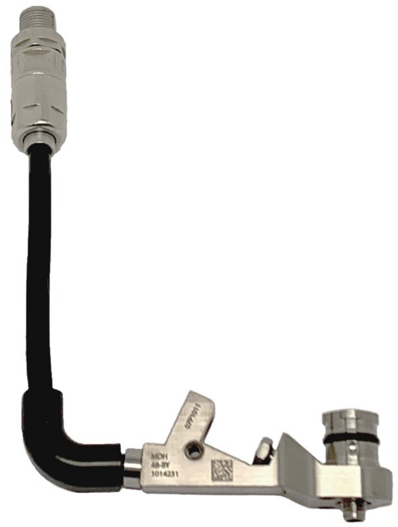


Fig. 60: MDH-48-BY

⚠ CAUTION

High temperatures, danger of burns

The nozzle heater can reach very high temperatures (e.g. of up to 180 °C with MDH-48-BY). Do not touch this area during operation. Afterwards only touch it once it has cooled down.

With a heater, you can control the dynamical viscosity of the fluid to be dispensed. For some liquids, dispensing without heating is impossible. Heating may also be required to ensure a constant process temperature, or when the dispensing has to take place above room temperature.

Information how to mount a heater you can find in paragraph 6.2, page 48. You then need the heater cable 48 V, to connect the heater to the MDC (see paragraph 6.3.3.4, page 56).

INFORMATION

Wait with adjust for heater

If you are using a heater with your application, you should turn it on before you perform the adjust. The adjust is more accurate if it is performed at the same temperature that will be used for the application. You have to wait until the heater has warmed up before you can perform the adjust. During this time, the heating-LED flashes and the display shows the message "Please wait for the heating!" However, you can skip this waiting time by pressing the [**esc**]-key.

If you do not skip the heating phase, the message "Adjust screw OUT Press Enter" will appear at some point and the heating-LED will light up permanently. Now you can start the adjust by pressing the [**enter**]-key.

7.13.1 Heater and MDC

You can activate the heater via the heater submenu in the MDC menu (see picture below). Use the **[enter]** and arrow keys to navigate down to the submenu "Heater" in the menu "Cooler/Heater". Here you can switch ON the heater (menu item "Heater ON/OFF") and set the temperature (menu item "Heater Temp."). The possible temperature range depends on the connected heater (e.g. for MDH-48-BY it lies between 10 °C and 180 °C). (Further information about the menu of the control unit you can find in paragraph 4.5.3.2, page 31.)

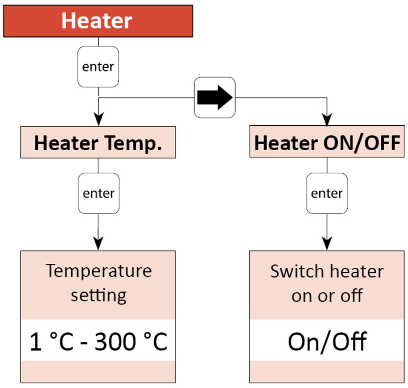


Fig. 61: Submenu Heater

INFORMATION

Control heater via serial commands

The heater can also be controlled via the serial interface. The relevant commands and information can be found in paragraph 8.1.2, page 90.

7.13.2 Calibration of the Heater

You should calibrate the temperature settings of your heater in regular intervals. We recommend to do the calibration once a year. VERMES Microdispensing offers a calibrator set (Calibrator set for MFC 3000, order no. 1015434, see Fig. 62, page 84). The set contains two calibrators for different temperatures:

Calibrator MFC3000 – 20°C (blue, as single product order no. 1015437)

Calibrator MFC3000 – 200°C (red, as single product order no. 1015436)

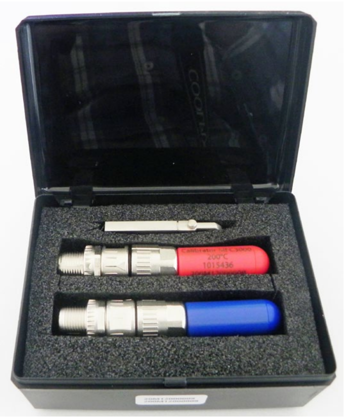
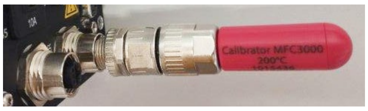


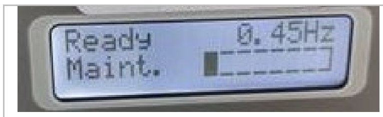
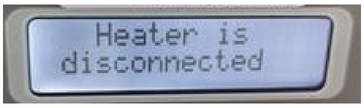
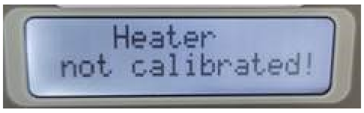
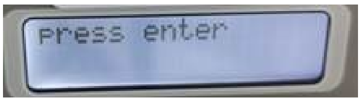
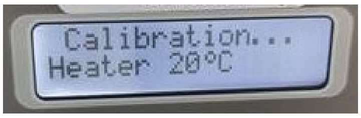
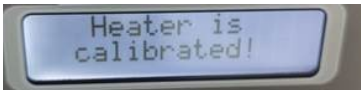
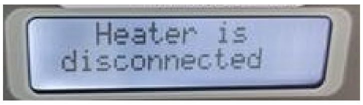
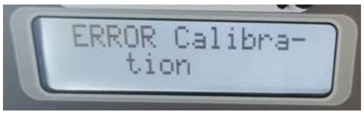
Fig. 62: Calibrator Set

You do not need the additional USB flash drive coming with the calibrator, if you work with an MDC 3500-V. The USB flash drive is only for other devices.

You have to calibrate your heater twice, once at 200 °C and once at 20 °C. You always have to calibrate at both temperatures, since the old values are deleted the moment you start a new calibration. It does not matter, in which order you perform the calibrations, as long as you use each calibrator exactly once.

The following table shows you how to perform the calibration.

Picture	Explanation
 Ready 0.45Hz Maint.	**Preparation** The MDC is connected with a microdispensing valve, but not with a heater. Start up the MDC. The starting menu appears in the display.
 Heater connected + press enter *or* Heater not calibrated! + press enter	**Step 1 (First Calibrator gets connected)** Connect the calibrator MFC3000 – 200°C. **Important Note!** Make sure to screw the calibrator tight enough. There are now two possibilities. If the MDC had been calibrated before, the message “Heater connected” appears in the display. The display then switches between this message and the message “Press enter”. If the MDC had not been calibrated before, or if there was an error during the last calibration attempt, the message “Heater not calibrated” appears. Similar to the case above, the display switches between this message and the message “Press enter”. Press the [**Enter**]-key.
 Calibration... Heater 200°C	**Step 2 (First calibration is running)** After several seconds, in the display appears the message “Calibration … Heater 200°C”.

 Ready 0.45Hz Maint.	Wait until the display jumps back to the starting message.
 Heater is disconnected	**Step 3 (First calibrator screwed off)** Screw off the calibrator. In the display, you get the message “Heater is disconnected”.
 Heater not calibrated! +  press enter	**Step 4 (Second Calibrator gets connected)** Connect the calibrator MFC3000 – 20°C. **Important Note!** Make sure to screw the calibrator tight enough. In the display, the message “Heater not calibrated” appears. The display then switches between this message and the message “Press enter”. Press the [**Enter**]-key.
 Calibration... Heater 20°C *then*  Heater is calibrated!	**Step 5 (Second calibration is running)** After several seconds, in the display appears the message “Calibration … Heater 20°C”. Wait until a new message appears: Heater is calibrated. The calibration has been completed.
 Heater is disconnected	**Step 6 (Calibration completed, second calibrator screwed off)** The calibration has been completed successfully. Screw off the calibrator. In the display, you get the message “Heater is disconnected”.
 ERROR Calibra- tion	**Error during calibration** In case an error happens during the calibration, in the display appears the message “Error Calibration” for approx. 2 s. There can be different causes for an error, e.g. • calibration stopped too early • communication was interrupted • calibrator not correctly connected • you used the same calibrator twice • defect at the MDC Once you have solved the problem, you have to repeat the complete calibration, starting at step 1. **Information!** In case of an error during the calibration, the values are set back to the default values. You will be able to work with these values, but the results will not be as precise as with a correctly calibrated heater.

Tab. 26: Calibration of the heater

Once the full calibration is completed, you can proceed with the normal work at your application.

7.14 Dispensing with a Cooling Valve

The Microdispensing System MDS 3581-V can optionally be equipped with a flow control valve as a cooling valve (meaning: to cool the microdispensing valve). One option is the FCV-AC 6.0 M12 (see Fig. 63). More detailed information about the menu, while using a cooling valve, you can find in paragraph 4.5.3.1, page 31 and paragraph 7.14.1, page 86.

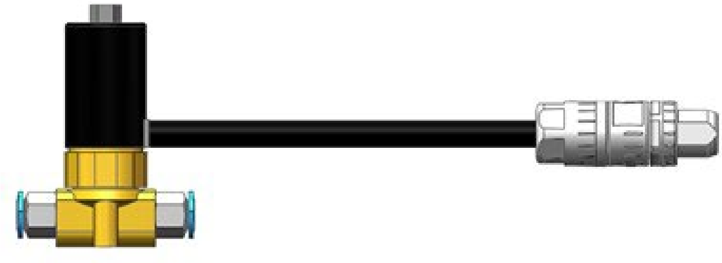


Fig. 63: FCV-AC 6.0 M12

A VERMES Microdispensing Valve works best, if the temperature inside the valves stays below a certain limit. E.g. for the MDV 3581-V this limit is at 80 °C for the actuator system. For this reason, microdispensing valves can be fitted with an air cooling adapter (see Fig. 34, page 59).

With the MDC 3500-V, it is possible to control the airflow according to the temperature inside the valve. This improves the dispensing accuracy and allows you to save compressed air costs.

To regulate the compressed air flow, the MDC controls a flow control valve, e.g. the FCV-AC 6.0 M12 (see Fig. 63). It regulates the air flow between your compressed air supply and the microdispensing valve you want to cool.

At the same time, the MDC is connected with the sensor module of the microdispensing valve and receives the temperature values from inside the valve. This grants the MDC the information needed to keep the target temperature in the correct range by increasing or decreasing the cooling airflow as necessary. You can also set a cooler offset, which creates a minimum airflow, independent of the regulation (menu item “Cooler Offset”, see paragraph 7.14.1, page 86).

The compressed air connectors of the VERMES flow control valves are marked on one side, “1” is “IN” and “F” is “out. These connectors have 6 mm diameter. If you want to connect the valve with a microdispensing valve with 3 mm connectors, you need a 6 mm to 3 mm adapter.

How to mount a flow control valve for cooling the MDV, you can find in paragraph 6.3, page 52. With the Connection Cable for FCV-AC/HF M12 to MDC, you connect the flow control valve to the MDC (see paragraph 6.3.3.5, page 57). Information on how to connect the compressed air supply onto the MDV and for the necessary minimum quality of the compressed air you can find in paragraph 6.4, page 59.

INFORMATION

Adjust-LED and cooling

The green adjust-LED indicates that cooling is activated when the Adjust is not running (see paragraph 4.2, page 21). If you run an adjust while cooling is active, the adjust-LED indicates the status of the adjust for this period of time. After that, it automatically returns to indicating the cooling status.

7.14.1 Cooling and MDC

You can activate the cooling via the cooler submenu in the MDC menu (see picture below). Use the **[enter]** and arrow keys to navigate down to the submenu “Cooler” in the menu

"Cooler/Heater". Here you can switch ON the cooling (menu item "Cooler ON/OFF"), set a cooler offset (menu item "Cooler Offset", see also paragraph 7.14.2, page 87) and set the target temperature (menu item "Cooler Temp."). The possible temperature range lies between 10 °C and 120 °C. (Further information about the menu of the control unit you can find in paragraph 4.5.3.1, page 31.)

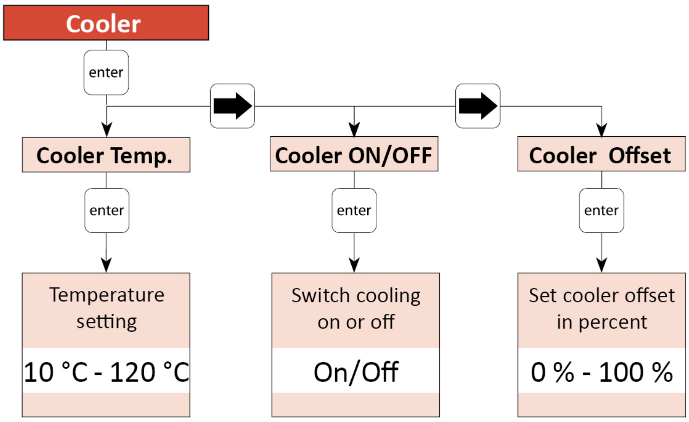


Fig. 64: Submenu Cooler

INFORMATION

Control cooling via serial commands

The cooling can also be controlled via the serial interface. The relevant commands and information can be found in paragraph 8.1.2, page 90.

7.14.2 Cooler Offset

The cooler offset sets an offset value for the flow control valve (in %), which is independent from the regulation system. The cooler offset allows for a constant airflow through the valve, even if the regulation system does not require an airflow yet. Only when the regulation system requires an airflow above the cooler offset, the regulation takes over. I.e. the cooler offset is not added to the normal value, but sets a minimum value.

Using a cooler offset can be helpful in some applications, e.g. if your application has many short but intense bursts. For such an application, the regulation could be a bit slow, if it always drops back to zero airflow.

Use the arrow keys to reach the menu item "Cooler Offset" within the submenu "Cooler" (see paragraph 7.14.1, page 86). Press the [**enter**]-key and then use the arrow keys to set the desired value. A value of 0 % means that the cooler offset is deactivated. A value of 100 % would mean that the flow control valve is always opened completely.

7.15 Switching OFF the Microdispensing System

- Step 1: The current dispensing cycle must be completed, so that the valve is in home position.
- Step 2: Lower the supply pressure to atmospheric pressure (because in initial position, the valve is still opened). Disengage the pneumatic supply. If required, close the cartridge by using locking pin MDT 309.
- Step 3: Switch OFF the control unit (ON/OFF button at the rear end). After switching OFF the control unit, please wait a few seconds.
- Step 4: Disconnect the valve from fluid supply.
- Step 5: Remove all cables from the valve.
- Step 6: Unscrew the screws used for fixing the valve in place.

After working with self-curing substances, immediate cleaning is advisable in order to avoid clogging. This concerns the valve itself and all parts in contact with the fluid. The valve and its subcomponents have to be dismantled and cleaned (see chapter 9, page 136).

8 Communication Interfaces

The control unit has three communication interfaces. There is a 9-pin serial interface, RS-232C, a 15-pin PLC-interface and an AUX socket.

8.1 Serial Interface RS-232C: 9-Pin Sub-D

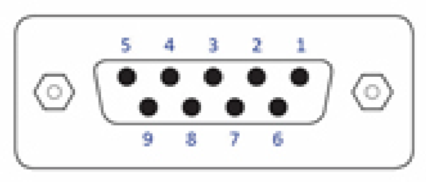


Fig. 65: Serial interface

The local interface is structured according to SCPI Standard.

These “Standard Commands for Programmable Instruments” represent a standardized set of instructions used for control and programming, transmitted in form of ASCII text. They can be generated by any selectable programming language in any environment. The serial interface operates by means of software handshake. The hardware handshake communications are not in use.

INFORMATION

Communication while triggering

Do not send instructions through this interface in the course of a running dispensing cycle. Communication is only possible between distinct sequences (signal DosOK on “high”). This is especially important during start-up of a heater.

After sending data or parameters to the control unit, you have to wait for the “OK” signal before you can start further actions. You only can send data while the MDC is in the main menu.

8.1.1 Pin Functions

PIN	Characteristics	Level	Function
1	Reserved	____________	____________
2	Output	TX	Serial transmission signal
3	Input	RX	Serial reception signal
4			Connected to PIN 6
5	Ground		Ground
6			Connected to PIN 4
7	Reserved	____________	____________
8	Reserved	____________	____________
9	Reserved	____________	____________

The RS-232C log of the control unit uses RS-232C standard and is designed for communication via a serial cable, connected 1:1, with a Sub-D nine pin connector.

The following parameter configuration is used for the communication with the control unit:

- Synchronous mode: Half-duplex
- Bits/s: 9600 – 115200 (5 different options available, see paragraph 4.5.6, page 37)
- Start bit: 1
- String length: 8 bit (ASCII)
- Parity: None
- Stop bit: 1
- Log: None

8.1.2 RS-232C Commands

The available commands are listed below. They are explained on the following pages, together with short examples. This list is according to firmware revision 4185AA1-F.

Each command has to be followed by a line feed (LF, \n, 0x0a) and then a carriage return (CR, \r, 0x0d). It is important to keep to this order!

INFORMATION

Response to commands

The control unit gives a response to every command send to her. Possible answers are:

- A value or set of value, asked for in the command
- OK, to acknowledge a command sent
- NAK ("not acknowledged"), if command sent was incorrect (e.g. incomplete set of values or a value outside the range, or after start-up a wrong command while the display shows the message "Please do Adjust")
- "Auxiliary Mode", if you send the command "SYSTEM:SHOW:VALVEID" while the system is in the auxiliary mode.

If there is no response to a command, either the connection is interrupted (e.g. malfunctioning cable or interface) or the command did not end in a carriage return (0x0d).

The reaction times for the commands are given in the table in the next chapter. The table lists the values for the highest and lowest baud rate, since these have a great influence on the times. The length of a response is also influential. There it makes e.g. a big difference with the ESR commands, if there are only a few errors reported or many of them. Please be aware that your hardware also influences the reaction times. Therefore, the given times are only guidelines.

8.1.2.1 Explanation of trigger commands

With the command TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>, you can change the pulse parameters (see paragraph 8.1.2.3, page 95). The result varies slightly, by adding specific characters in certain positions of the command (as shown below):

STRIGGER:**A**SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**,1**

The table below lists possible characters in each position.

Position 1	TRIGGER:	Position 2	SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Position 3
With "S", MDC returns the given parameters		With "A", "Rising" is in 1/100 ms		With "1", save the changed parameters for future use
Without "S", MDC returns "OK"		Without "A", "Rising" is in 1/10 ms		Without "1", the changed parameters

				will get lost once the MDC is OFF

Tab. 27: Characters in the command “TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>”

The explanation below will help you understand the characters in the command.

- If an “S” is added at the beginning of the command, MDC will return the given parameters. If without the “S”, MDC will only return “OK”.

  Example:

  Command to MDC: STRIGGER:SET:10,10,15,80,20,8

  Return from MDC: 10,10,15,80,20,8

  Result: the pulse parameters are changed as below and will be displayed.

  Rising: 1.0 ms, Open Time: 1.0 ms, Falling: 0.15 ms, Needle Lift: 80%, Number of Pulses: 20, Delay: 0.8 ms

- If an “A” is added between “TRIGGER:” and “SET:”, “Rising” is specified in 1/100 ms. If without the “A”, “Rising” is specified in 1/10 ms.

  Example:

  Command to MDC: TRIGGER:ASET:55,10,8,80,20,15

  Return from MDC: OK

  Result: the pulse parameters are changed as below.

  Rising: 0.55 ms, Open Time: 1.0 ms, Falling: 0.08 ms, Needle Lift: 80%, Number of Pulses: 20, Delay: 1.5 ms

- If a “1” is added at the end of the command, the changed parameters will be saved for future use. If without “1”, the changed parameters will get lost, once the MDC is OFF.

  Example:

  Command to MDC: TRIGGER:SET:10,10,15,80,20,8,1

  Return from MDC: OK

  Result: the pulse parameters are changed as below and will be saved.

  Rising: 1.0 ms, Open Time: 1.0 ms, Falling: 0.15 ms, Needle Lift: 80%, Number of Pulses: 20, Delay: 0.8 ms

8.1.2.2 Overview

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
1. *ESR? (e.g. 50 errors)	1280	640
2. *ESR2? (e.g. 50 errors)	2190	640
3. *IDN?	110	70
4. *OPC?	80	70
5. ADJUST:?		
6. ADJUST:START	170	120
7. ADJUST:OFFSET:?	90	70
8. ADJUST:OFFSET:<offset value>	90	70
9. ADJUST:CALIBRATION:?	120	100
10. ADJUST: CALIBRATION:ON	210	190
11. HEATER:?	380	340
12. HEATER:ID:?	90	70
13. HEATER:OFF	130	120
14. HEATER:ON	80	70
15. HEATER:TEMP:<target temperature>	100	90
16. HEATER:LIMITS:<upper>,<lower>	150	130
17. COOLER:?	80	70
18. COOLER:ID:?	90	70
19. COOLER:OFF	130	120
20. COOLER:ON	130	120
21. COOLER:TEMP:<target temperature>	100	90
22. COOLER:OFFSET:<offset>	100	90
23. KEY:ENTER	80	70
24. KEY:ESCAPE	80	70
25. HELP	1880	640
26. LCD?	380	340
27. MAINT:STATUS	690	340
28. MAINT:MESSAGE:OFF	100	90
29. MAINT:MESSAGE:ON	100	80
30. SYSTEM:KLOCK:OFF	90	70
31. SYSTEM:KLOCK:ON	90	70
32. SYSTEM:SHOW:CYCLES	90	70
33. SYSTEM:SHOW:VALVEID	90	70
34. SYSTEM:SHOW:CONTROLLERID	100	70

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
35. SYSTEM:SHOW:STATUS	690	340
36. SYSTEM:SHOW:ACTTEMP	90	70
37. SYSTEM:DOSOKDELAY:OFF	110	90
38. SYSTEM:DOSOKDELAY:ON	110	80
39. SYSTEM:SINGLEDOSOK:SETUP	110	90
40. SYSTEM:SINGLEDOSOK:PULSE	110	80
41. SYSTEM:PASSWORD:<your password>	90	70
42. SYSTEM:PASSWORD:OFF	100	80
43. SYSTEM:PASSWORD:ON	100	90
44. SYSTEM:PASSWORD:SET:<your password>	110	90
45. SYSTEM:AUXILIARYMODE:OFF	100	70
46. SYSTEM:AUXILIARYMODE:ON	100	70
47. SYSTEM:MULTIDOT:OFF	160	140
48. SYSTEM:MULTIDOT:ON	160	140
49. TRIGGER:SET:?	390	340
50. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	130	90
51. TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	150	100
52. TRIGGER:ASET:?	390	340
53. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	130	90
54. TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	150	100
55. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	90	80
56. STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	120	110
57. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	400	350
58. STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	430	370
59. VALVE:UP	80	70
60. VALVE:DOWN	80	70
61. VALVE:AOPEN	80	70
62. VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	130	90
63. VALVE:AOPENS<setup no.>	90	70
64. SVALVE:AOPEN	380	340
65. SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	430	360
66. SVALVE:AOPENS<setup no.>	390	340
67. WRITE:LCD:<text>	110	70
68. TAPPET:SET:<value>	200	180
69. TAPPET:CLEAR	190	180
70. NOZZLE:SET:<value>	200	180

RS-232C commands	Reaction time (ms)	
	For baud rate:	
	9600 bits/s	115200 bits/s
71. NOZZLE:CLEAR	190	180
72. SCENARIO:STATUS	690	340
73. SCENARIO:OFF	100	80
74. SCENARIO:ON	100	80
75. SCENARIO:PLCSTOP:1:OFF	140	120
76. SCENARIO:PLCSTOP:1:ON	140	120
77. SCENARIO:SAVE:<scenario no.>:<values>	280	130
78. SCENARIO:READ:<scenario no.>	690	340
79. SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	570	530
80. SETUP:AREAD:<setup no.>	390	340
81. BAUDRATE:0/1/2/3/4	80	70
82. GETTD	80	70
83. MDC:RESTART	190	180

8.1.2.3 Explanations

1	***ESR?**	**ESR? = Event Status Register Query**	
	Description:	This command shows the latest error codes created by the system, starting with the latest event. At the most 50 error messages will be shown. Each error messages also includes the valve ID (if known) and a time and date stamp. If the RTC of the MDC is defect, the value will be given as “00:00:00 2014-01-01”. **Information!** In case no error has been registered yet, the response will be “error list is empty”.	
	Example:	Input:	*ESR?
		Result:	List of the (up to 50) latest error messages
		Return:	8 199 valve error 08FU04 09:16:38 2018-01-21 9 101 wrong valve 08FU04 09:16:21 2018-01-21

2	***ESR2?**	**ESR2? = Event Status Register Query 2**	
	Description:	This command shows the latest error codes created by the system, starting with the latest event. There will be shown a max of 50 error messages. Each error messages also includes the valve ID (if known), a time and date stamp and the value of the cycle counter at the time of the error. If the RTC of the MDC is defect, the time stamp will be given as “00:00:00 2014-01-01”. Additionally, the parameters of Setup 0 before the error are listed. **Information!** In case no error has been registered yet, the response will be “error list is empty”.	
	Example:	Input:	*ESR2?
		Result:	List of the (up to 50) latest error messages with parameters
		Return:	20 199 valve error 000000 09:16:38 2018-01-21 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 0, 0, 0, 0, 0, 0 27 101 wrong valve 08FU04 09:16:21 2018-01-21 30, 5, 30, 80, 1, 20 50, 20, 20, 80, 1, 100 50, 20, 20, 80, 1, 100 50, 20, 20, 80, 1, 100

3	***IDN?**	**IDN? = Identification Query**	
	Description:	Device specific information, formatted as follows: type (hv or lv, high viscosity or low viscosity systems), software version. Important for contact with our Technical Support.	
	Example:	Input:	*IDN?
		Result:	Micro Dispenser HV, 4185AA1-F
		Return:	Micro Dispenser HV, 4185AA1-F

4	***OPC?**	**OPC? = Operation Complete Query**	
	Description:	Monitoring the last trigger impulses. After this, the counter is cleared to zero.	
	Example:	Input:	*OPC?
		Result:	Number of the last pulses. Clears the counter to zero.
		Return:	6699

5	**ADJUST:?**		
	Description:	This command is used to read the adjust status. The result consists in one of the following options: • An adjust was not performed (Result: 0) You need to perform the adjust during initial operation and after each exchange of the nozzle unit. • The adjust was aborted halfway (Result: 1) The adjust must be repeated. • The adjust was successful (Result: 2) The position of the nozzle insert relatively to the tappet is OK. **Information!** The adjust status is only saved in the RAM. Therefore, the result will be reset to “0” after restarting the MDC.	
	Example:	Input:	ADJUST:?
		Result:	The system informs about the current status of the adjust (here: the adjust was successful).
		Return:	2

6	**ADJUST:START**		
	Description:	Sending this command causes the adjust to be executed at once. This procedure checks on the position of the nozzle insert with respect to the tappet. It is required during each initial start-up and after replacing the nozzle unit. For further information read paragraph 8.2.3, page 132.	
	Example:	Input:	ADJUST:START
		Result:	The adjust is initiated.
		Return:	Adjust Screw OUT Press Enter

7	**ADJUST:OFFSET:?**		
	Description:	This command gives the current value of the adjust offset (see paragraph 7.12, page 81). The value can be between -5 and 5. The value 0 means, the adjust offset is deactivated. A negative value means, the system is tighter than normal. A positive value means, the system is looser than normal.	
	Example:	Input:	ADJUST:OFFSET:?
		Result:	The current value of the adjust offset is returned.
		Return:	5

8	**ADJUST:OFFSET:<offset value>**

	Description:	This command sets the value for the adjust offset (see paragraph 7.12, page 81). You can enter integer values between -5 and 5. With 0 you deactivate the adjust offset. A negative value means, the system is tighter than normal. A positive value means, the system is looser than normal.	
	Example:	Input:	ADJUST:OFFSET:5
		Result:	The value of the adjust offset is set (here: to 5).
		Return:	OK

9	**ADJUST:CALIBRATION:?**		
	Description:	This command gives the status of the (remote) adjust and the current adjust value. The response to this command contains seven numerical values. You can ignore the first six parameters limit at 0 %, limit at 100 %, difference, reference value, last mean value and total value). They are only there for our support, if there is an error with the (remote) adjust. The last parameter sent is the adjust value in percent. Be aware that the given value is the actual percentage value, multiplied by 10. Therefore, a given value of 8 represents an adjust value of 0.8 %.	
	Example:	Input:	ADJUST:CALIBRATION:?
		Result:	The status of the (remote) adjust is given, including the current adjust value.
		Return:	151285, 47623, 103662, 150836, 108654, 42182, 8

10	**ADJUST:CALIBRATION:ON**		
	Description:	This command activates the adjust, so that you can perform it as a remote adjust.	
	Example:	Input:	ADJUST:CALIBRATION:ON
		Result:	The adjust is activated.
		Return:	Adjust ON

11	**HEATER:?**		
	Description:	This command shows the state of the heater. This includes the following information. • T-point of the temperature calibration • M- point of the temperature calibration • Maximum temperature of the connected heater (°C) • the current target temperature (°C) • upper limit of allowed temperature range (°C x 10) • lower limit of allowed temperature range (°C x 10) • current temperature (°C) • calibration status (0 = no, 1 = yes) • current heater status (1 = ON, 2 = OFF, 4 = not calibrated, 5 = temperature settled in, 7 = plugged in, 8 = plugged out, 9 = calibration 20 °C, 10 = calibration 100 °C; XXXX communication error code) In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:?
		Result:	Switched ON or OFF, current temperature and target temperature and other information are given.
		Return:	1000, 20000, 180, 110, 30, 20, 109, 1, 5

12	**HEATER:ID:?**		
	Description:	This command shows the type and serial number of the heater. In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:ID:?
		Result:	Type and serial number of the heater are given.
		Return:	MDH-48-BY, 10UB1234

13	**HEATER:OFF**		
	Description:	The connected heater is turned off. In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:OFF
		Result:	The connected heater is deactivated.
		Return:	OK

14	**HEATER:ON**		
	Description:	The connected heater is turned on. In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:ON
		Result:	The connected heater is activated.
		Return:	OK

15	**HEATER:TEMP:<target temperature>**		
	Description:	This command changes the target temperature of the heater. The value has to be entered as degree centigrade, e.g. 100 = 100 °C. The target temperature value has to be between 1 °C and 230 °C. In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:TEMP:60
		Result:	The target temperature of the heater is set to 60 °C.
		Return:	OK

16	**HEATER:LIMITS:<upper>,<lower>**		
	Description:	With this command you set the upper and lower limit for the temperature regulation. The parameters say, by how many degrees the current temperature might be above/below the target temperature, before the MDC shows an error message. The values have to be given in 1/10th of a degree centigrade, i.e. 20 = 2.0 °C. Both parameters have to be between 5 (= 0.5 °C) and 100 (= 10.0 °C). **Information!** In case the temperature moves out of the given range, the error message does not appear immediately. Instead it comes several seconds later. This helps to avoid stopping the production too quickly because of a short temperature fluctuation. In case there is no heater connected, the response is “NAK”.	
	Example:	Input:	HEATER:LIMITS:10,22
		Result:	The actual temperature may be 1.0 °C higher and 2.2 °C lower than the target temperature, before an error message is send.
		Return:	OK

17	**COOLER:?**		
	Description:	This command shows the state of the cooling. This includes the following information. • T-point of the temperature calibration • M- point of the temperature calibration • the current target temperature (°C) • offset (%) • current actuator temperature (°C) • calibration status (0 = no, 1 = yes) • current cooling status (1 = ON, 2 = OFF, 4 = not calibrated, 7 = plugged in, 8 = error PT100, 9 = plugged out; XXXX communication error code) In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:?
		Result:	Switched ON or OFF, current actuator temperature and target temperature and other information are given.
		Return:	1000, 20000, 45, 0, 35, 1, 1

18	**COOLER:ID:?**		
	Description:	This command shows the type and serial number of the flow control valve. In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:ID:?
		Result:	Type and serial number of the flow control valve are given.
		Return:	FCV-AC 6.0 M12, 101501

19	**COOLER:OFF**		
	Description:	The connected flow control valve is deactivated. In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:OFF
		Result:	The connected flow control valve is deactivated.
		Return:	OK

20	**COOLER:ON**		
	Description:	The connected flow control valve is activated. In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:ON
		Result:	The connected flow control valve is activated.
		Return:	OK

21	**COOLER:TEMP:<target temperature>**		
	Description:	This command changes the target temperature of the cooling. The value has to be entered as 1/10th of a degree, i.e. 1000 = 100 °C. The target temperature value has to be between 100 (10 °C) and 1200 (120 °C). In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:TEMP:750
		Result:	The target temperature of the cooling is set to 75.0 °C
		Return:	ON,20°C,230V

22	**COOLER:OFFSET:<offset>**

	Description:	This command sets the cooler offset for the flow control valve which is connected to the MDC. The value has to be between 0 % and 100 %. The cooler offset allows for a constant airflow through the valve, even if the regulation does not require an airflow yet. The value is given in percent, i.e. allowed are integers between 0 and 100. This command has the same function as the menu item “Cooler Offset” in the submenu “Cooler”. In case there is no flow control valve connected, the response is “NAK”.	
	Example:	Input:	COOLER:OFFSET:10
		Result:	The cooler offset is set to 10 %.
		Return:	OK

23	**KEY:ENTER**		
	Description:	The acknowledgement signal is transferred to the control unit. This option is only usable in case of errors, which produce a message on the display of the MDC. You can respond with a serial command. Then the function is identical to pressing the **[enter]**-key on the keypad.	
	Example:	Input:	KEY:ENTER
		Result:	The ENTER signal is send.
		Return:	OK (no other reaction of the MDC)

24	**KEY:ESCAPE**		
	Description:	The ESCAPE signal is transferred to the control unit. This option is only usable in case of errors, which produce a message on the display of the MDC. You can respond with a serial command. Then the function is identical to pressing the **[esc]**-key on the keypad.	
	Example:	Input:	KEY:ESCAPE
		Result:	The ESCAPE signal is send.
		Return:	OK (no other reaction of the MDC)

25	**HELP**		
	Description:	Shows a list with all RS-232C commands.	
	Example:	Input:	HELP
		Result:	List with all RS-232C commands.
		Return:	List with all commands

26	**LCD?**	**LCD? = Liquid-Crystal Display Query**	
	Description:	Use this command to externally inspect the current content of the screen.	
	Example:	Input:	LCD?
		Result:	When sending this command immediately after switching ON, the content of the screen will be "READY".
		Return:	„READY“

27	**MAINT:STATUS**	**MAINT = Maintenance**	
	Description:	This command provides the number of pulses in percent of the preset limits. It is useful, if you want to estimate the date of the next exchange or maintenance. The answer will be send in one line.	
	Example:	Input:	MAINT:STATUS
		Result:	Current percentage of the preset number of cycles (limit).
		Return:	Maintenance: 10 %,Nozzle: 20 %,Tappet: 30 %,Maint. Message: ON

28	**MAINT:MESSAGE:OFF (MAINT = Maintenance)**		
	Description:	This command deactivates the maintenance message. The message “Maint.” will no longer be shown in line 2 of the display. Also the red maintenance LED will not be switched on, if the maintenance, nozzle or tappet limits are reached. By default, the maintenance message is activated.	
	Example:	Input:	MAINT:MESSAGE:OFF
		Result:	The maintenance message is deactivated.
		Return:	OK

29	**MAINT:MESSAGE:ON (MAINT = Maintenance)**		
	Description:	This command activates the maintenance message. The message “Maint.” will be shown in line 2 of the display. Also, the red maintenance LED will be switched on, if the maintenance, nozzle or tappet limits are reached. By default, the maintenance message is activated.	
	Example:	Input:	MAINT:MESSAGE:ON
		Result:	The maintenance message is activated.
		Return:	OK

30	**SYSTEM:KLOCK:OFF (KLOCK = Key Lock)**		
	Description:	Access to keypad is permitted, the locking function disabled.	
	Example:	Input:	SYSTEM:KLOCK:OFF
		Result:	The keypad of the control unit can be used.
		Return:	OK

31	**SYSTEM:KLOCK:ON (KLOCK = Key Lock)**		
	Description:	This command locks the keypad of the control unit. This way, unauthorized modification of parameters can be prevented.	
	Example:	Input:	SYSTEM:KLOCK:ON
		Result:	The keypad is locked.
		Return:	OK

32	**SYSTEM:SHOW:CYCLES**		
	Description:	The current value of the cycle counter is indicated.	
	Example:	Input:	SYSTEM:SHOW:CYCLES
		Result:	Current value of the cycle counter.
		Return:	1235000

33	**SYSTEM:SHOW:VALVEID**		
	Description:	The valve ID is displayed. In case the system is in auxiliary mode, the return is “Auxiliary Mode”.	
	Example:	Input:	SYSTEM:SHOW:VALVEID
		Result:	ID of the connected valve.
		Return:	Valve ID: 10PEA001

34	**SYSTEM:SHOW:CONTROLLERID**		
	Description:	The ID of the control unit is displayed.	
	Example:	Input:	SYSTEM:SHOW:CONTROLLERID
		Result:	ID of the control unit.
		Return:	Controller ID: 12060

35	**SYSTEM:SHOW:STATUS**		
	Description:	This command sends the current status of KeyLock, DosOK with Delay, SingleDosOK, Auxiliary Mode and Multi Dot Mode.	
	Example:	Input:	SYSTEM:SHOW:STATUS
		Result:	Settings of the above listed items
		Return:	KeyLock: OFF DosOK with Delay: OFF SingleDosOK: per pulse Auxiliary Mode: OFF Multi Dot Mode: OFF

36	**SYSTEM:SHOW:ACTTEMP**		
	Description:	The current temperature of the actuator (piezo) is displayed. **Important Note!** In case an MFC is connected to your MDC, you cannot use this command, since it would respond with a wrong value.	
	Example:	Input:	SYSTEM:SHOW:ACTTEMP
		Result:	The value appears in °C.
		Return:	70

37	**SYSTEM:DOSOKDELAY:OFF**		
	Description:	This command deactivates the DOSOK-Delay. When this is true, the length of a delay is not added to the length of the DOSOK signal. (Default setting is “delay OFF”.)	
	Example:	Input:	SYSTEM:DOSOKDELAY:OFF
		Result:	Deactivates the DOSOK-delay.
		Return:	OK

38	**SYSTEM:DOSOKAYDELAY:ON**		
	Description:	This command activates the DOSOK-Delay. When this is true, the length of a delay is added to the length of the DOSOK signal. (Default setting is “delay OFF”.)	
	Example:	Input:	SYSTEM:DOSOKDELAY:ON
		Result:	Activates the DOSOK-delay.
		Return:	OK

39	**SYSTEM:SINGLEDOSOK:SETUP**		
	Description:	This command sets the Single-DOSOK signal to “Setup”. The length of the Single-DOSOK signal is that of the setup. (Default setting is “Pulse”.)	
	Example:	Input:	SYSTEM:SINGLEDOSOK:SETUP
		Result:	The Single-DOSOK is set to “setup”.
		Return:	OK

40	**SYSTEM:SINGLEDOSOK:PULSE**		
	Description:	This command sets the Single-DOSOK signal to “Pulse”. The length of the Single-DOSOK signal is that of a pulse. (Default setting is “Pulse”.)	
	Example:	Input:	SYSTEM:SINGLEDOSOK:PULSE
		Result:	The Single-DOSOK is set to “pulse”.
		Return:	OK

41	**SYSTEM:PASSWORD:<Your password>**		
	Description:	This command sends the 6-digit password to unlock the keypad after a PLC-trigger. Each digit can be either of 1, 2, 3 or 4 (representing the keys “**[←]**”, “**[↑]**”, “**[↓]**” and “**[→]**” resp.)	
	Example:	Input:	SYSTEM:PASSWORD:111111
		Result:	The keypad is unlocked.
		Return:	OK

42	**SYSTEM:PASSWORD:OFF**		
	Description:	This command deactivates the password, which unlocks the keypad after a PLC-trigger.	
	Example:	Input:	SYSTEM:PASSWORD:OFF
		Result:	The password is deactivated.
		Return:	OK

43	**SYSTEM:PASSWORD:ON**		
	Description:	This command activates the password, which unlocks the keypad after a PLC-trigger.	
	Example:	Input:	SYSTEM:PASSWORD:ON
		Result:	The password is activated.
		Return:	OK

44	**SYSTEM:PASSWORD:SET:<Your password>**		
	Description:	This command sets the 6-digit password, which can unlock the keypad after a PLC-trigger. The password is 6-digit, with each digit either of 1, 2, 3 or 4 (representing the keys “**[←]**”, “**[↑]**”, “**[↓]**” and “**[→]**” resp.). The password has to be **exactly** six digits long; anything else would lead to an error.	
	Example:	Input:	SYSTEM:PASSWORD:SET:111111
		Result:	The 6-digit password is set.
		Return:	OK

45	**SYSTEM:AUXILIARYMODE:OFF**		
	Description:	This command deactivates the auxiliary mode. In auxiliary mode, the valve is disconnected. All other functionalities of the MDC can be used and tested.	
	Example:	Input:	SYSTEM:AUXILIARYMODE:OFF
		Result:	The auxiliary mode is deactivated.
		Return:	OK

46	**SYSTEM:AUXILIARYMODE:ON**		
	Description:	This command activates the auxiliary mode. In auxiliary mode, the valve is disconnected. All other functionalities of the MDC can be used and tested.	
	Example:	Input:	SYSTEM:AUXILIARYMODE:ON
		Result:	The auxiliary mode is activated.
		Return:	OK

47	**SYSTEM:MULTIDOT:OFF**

	Description:	This command deactivates the multi dot mode (see paragraph 7.9.4, page 76). Default setting is OFF.	
	Example:	Input:	SYSTEM:MULTIDOT:OFF
		Result:	The multi dot mode is deactivated.
		Return:	OK

48	**SYSTEM:MULTIDOT:ON**		
	Description:	This command activates the multi dot mode (see paragraph 7.9.4, page 76). Default setting is OFF. **Information!** To use the multi dot function, scenario mode needs to be set to ON as well. In case Scenario Mode is OFF, the response will be NAK.	
	Example:	Input:	SYSTEM:MULTIDOT:ON
		Result:	The multi dot mode is activated.
		Return:	OK

49	**TRIGGER:SET:?**		
	Description:	The pulse parameter set currently present in the RAM is displayed in the following order: Rising, Open Time, Falling, Needle Lift, Number of Pulses, Delay. Parameters relating to time are indicated in 1/10 ms, except for “Falling” which is given in 1/100 ms. If the valve is currently operated in external mode, the value for “Open Time” is “EXTERNAL”. In infinite mode, the number of pulses is always “0”.	
	Example:	Input:	TRIGGER:SET:?
		Result:	Information is given about the current cycle parameters. Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,80,20,8

50	**TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify cycle parameters. Parameters relating to time have to be specified in 1/10 ms, except for “Falling”, which has to be entered in 1/100 ms. Values lower than “1” are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:OPEN”. **Information!** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the “1” at the end.)	
	Example:	Input:	TRIGGER:SET:10,10,15,80,20,8
		Result:	This assigns the following values to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	OK

51	**TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	This command is used to modify cycle parameters and to save them in the EEPROM in the control unit (reaction time: 200 ms). The entered set thus remains available for future use. (That marks the difference to the command before this one. It is shown in the command line with the “1” at the end.) A trigger signal is not launched, but can be initiated by means of the command “VALVE:OPEN”, so that a dispensing cycle with this parameter set immediately starts. Parameters relating to time have to be specified in 1/10 ms, except for “Falling”, which has to be entered in 1/100 ms. Values lower than “1” are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value.	
	Example:	Input:	TRIGGER:SET:10,10,15,80,20,8,1
		Result:	The following values are assigned to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms

		Return:	OK

52	**TRIGGER:ASET:?**		
	Description:	This command gives the values for the pulse parameters currently saved in the RAM. The correct order of the values is: Rising, Open Time, Falling, Needle Lift, Number of Pulses, Delay. Parameters relating to time are indicated in 1/10 ms, except for “Falling” and “Rising” which are given in 1/100 ms. If the valve is currently operated in external mode, the value for “Open Time“ is “EXTERNAL“. In infinite mode, the number of pulses is always “0”.	
	Example:	Input:	TRIGGER:ASET:?
		Result:	Information is given about the current cycle parameters. Rising: 55 ≙ 0.55 ms (ms = milliseconds) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	55,10,8,80,20,15

53	**TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify pulse parameters without transmitting the trigger signal. The values for both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. Minimum value for “Falling” is 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”. **Information!** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the “1” at the end.)	
	Example:	Input:	TRIGGER:ASET:55,10,8,80,20,15
		Result:	The following values are assigned to the dispensing parameters: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	OK

54	**TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	As described pulse parameters can be modified and saved in EEPROM in the control unit (reaction time: 200 ms). (The latter marks the difference to the command before this one. It is shown in the command line with the “1” at the end.) It does not transmit a trigger signal. In this case, both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. Minimum value for “Falling”: 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”.	
	Example:	Input:	TRIGGER:ASET:55,10,8,80,20,15,1
		Result:	The following values are assigned: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	OK

55	**STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify cycle parameters. If you intend to save this configuration in the EEPROM, refer to the command described next. Parameters relating to time have to be specified in 1/10 ms, except for “Falling”, which has to be entered in 1/100 ms. Values lower than “1” are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:OPEN”. This command works just like its “TRIGGER” variant. Only the MDC does not answer with “OK”, but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly. **Information!** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the “1” at the end.)	
	Example:	Input:	STRIGGER:SET:10,10,15,80,20,8
		Result:	This assigns the following values to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,80,20,8

56	**STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	This command is used to modify cycle parameters and to save them in the EEPROM in the control unit (reaction time: 200 ms). The entered set thus remains available for future use. (That marks the difference to the command before this one. It is shown in the command line with the "1" at the end.) A trigger command is not launched, but can be initiated by means of the command "VALVE:OPEN", so that a dispensing cycle with this parameter set immediately starts. Parameters relating to time have to be specified in 1/10 ms, except for "Falling", which has to be entered in 1/100 ms. Values lower than "1" are not admissible. Therefore the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.1 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. This command works just like its "TRIGGER" variant. Only the MDC does not answer with "OK", but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly.	
	Example:	Input:	STRIGGER:SET:10,10,15,80,20,8,1
		Result:	The following values are assigned to the parameters: Rising: 10 ≙ 1.0 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 8 ≙ 0.8 ms
		Return:	10,10,15,80,20,8

57	**STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command is used to modify pulse parameters without transmitting the trigger signal. The values for both of the parameters "Falling" and "Rising" are specified in steps of 0.01 ms. Minimum value for "Falling" is 0.01 ms, for "Rising" 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter "EXTERNAL" for "Open Time", instead of a numerical value. You have to include all six setup parameters. The start of a dispensing cycle with the selected parameter configuration is initiated by the command "VALVE:AOPEN". This command works just like its "TRIGGER" variant. Only the MDC does not answer with "OK", but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly. **Information!** With this command, the information is only held in the RAM and therefore gets lost, once the system is switched OFF. If that is a problem, use the next command instead. (The difference in the command line is the "1" at the end.)	
	Example:	Input:	STRIGGER:ASET:55,10,8,80,20,15
		Result:	The following values are assigned to the dispensing parameters: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	55,10,8,80,20,15

58	**STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1**		
	Description:	As described pulse parameters can be modified and saved in EEPROM in the control unit (reaction time: 200 ms). (The latter marks the difference to the command before this one. It is shown in the command line with the “1” at the end.) It does not transmit a trigger command. Both of the parameters “Falling” and “Rising” are specified in steps of 0.01 ms. Minimum value for “Falling”: 0.01 ms, for “Rising” 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4, page 70). All other time parameters are entered in units of 1/10 ms. Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. The start of a dispensing cycle with the selected parameter configuration is initiated by the command “VALVE:AOPEN”. This command works just like its “TRIGGER” variant. Only the MDC does not answer with “OK”, but with the saved parameters instead. This way the machine software can check directly, if the parameters were received correctly.	
	Example:	Input:	STRIGGER:ASET:55,10,8,80,20,15,1
		Result:	The following values are assigned: Rising: 55 ≙ 0.55 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 8 ≙ 0.08 ms Needle Lift: 80 ≙ 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	55,10,8,80,20,15

59	**VALVE:UP**		
	Description:	The valve is opened until it receives the command “VALVE:DOWN” or closes automatically after 2 min. During this phase, other commands are ignored in order to protect the valve.	
	Example:	Input:	VALVE:UP
		Result:	The valve opens.
		Return:	OK

60	**VALVE:DOWN**		
	Description:	This command closes the valve. It is the only command accepted in a “VALVE:UP” phase. In other situations, it has no effect.	
	Example:	Input:	VALVE:DOWN
		Result:	The valve closes.
		Return:	OK

61	**VALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 35), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 72), the setup (or scenario) is determined by them. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPEN
		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 74). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 35), then the parameters of scenario 1 are chosen. If the select pins are activated, the setup (or scenario) is determined by them.
		Return:	OK

62	**VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	With this command, both of the parameters “Rising” and “Falling” are specified in steps of 1/100 ms, in contrast to the other time parameters (1/10 ms). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by “TRIGGER:ASET” are not erased, but the combination remains in the system only until the end of the cycle. If you do not wish to reenter the entire command several times, the “TRIGGER:ASET” command is advantageous. This way the cycle can be reactivated simply by “VALVE:AOPEN”. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPEN: 30,10,15,80,20,15
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 0.3 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	OK

63	**VALVE:AOPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is “ON”), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON“) • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON“) • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON“) • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON“) These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: VALVE:AOPENS2 For this example, SCENARIO has to be “OFF” in the menu. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	VALVE:AOPENS2
		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins, see paragraph 7.9, page 74).
		Return:	OK

64	**SVALVE:AOPEN**		
	Description:	This command initiates a dispensing cycle with the parameter combination currently selected. Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 35), then the parameters of scenario 1 are chosen. If the select pins are activated (see paragraph 7.8, page 72), the setup (or scenario) is determined by them. This command works just like its “VALVE” variant. Only the MDC does not answer with “OK”, but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPEN
		Result:	The system launches a dispensing cycle, using the parameters given by the working configuration, scenario 1 or the select pins, respectively (for further information about scenarios and the select pins, see paragraph 7.9, page 74). Usually this is the working configuration (setup 0). But if in the menu SCENARIO is ON (see paragraph 4.5.5, page 35), then the parameters of scenario 1 are chosen. If the select pins are activated, the setup (or scenario) is determined by them.
		Return:	30,10,15,80,20,15

65	**SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	With this command, both of the parameters “Rising” and “Falling” are specified in steps of 1/100 ms, in contrast to the other time parameters (1/10 ms). Specified values must be integer and positive. To choose the external mode, enter “EXTERNAL” for “Open Time”, instead of a numerical value. You have to include all six setup parameters. Parameters previously entered by “TRIGGER:ASET” are not erased, but the combination remains in the system only until the end of the cycle. If you do not wish to reenter the entire command several times, the “TRIGGER:ASET” command is advantageous. This way the cycle can be reactivated simply by “SVALVE:AOPEN”. This command works just like its “VALVE” variant. Only the MDC does not answer with “OK”, but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPEN: 30,10,15,80,20,15
		Result:	The dispensing cycle contains the following values: Rising: 30 ≙ 0.3 ms (ms = Millisecond) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	30,10,15,80,20,15

66	**SVALVE:AOPENS<setup no.>**		
	Description:	This command initiates a dispensing cycle with the parameter combination of the setup (or scenario) indicated in the command. You decide to dispense with the parameters of a specified setup (or scenario, if SCENARIO is “ON”), by using one of the following command extensions: • S0 - uses parameters of setup 0 (or scenario 1 with SCENARIO „ON“) • S1 - uses parameters of setup 1 (or scenario 2 with SCENARIO „ON“) • S2 - uses parameters of setup 2 (or scenario 3 with SCENARIO „ON“) • S3 - uses parameters of setup 3 (or scenario 4 with SCENARIO „ON“) These parameters are used even with activated select pins. As an example, to dispense with the parameters of setup 2 you have to enter the following command: SVALVE:AOPENS2 For this example, SCENARIO has to be “OFF” in the menu. This command works just like its “VALVE” variant. Only the MDC does not answer with “OK”, but with the parameters, which were used to trigger. This way the machine software can check the parameters directly. **Important Note!** In case you trigger a dispensing process in the Infinite Mode with this command, you **cannot** stop it via the RS232C interface. You can only stop it via the PLC-interface or by pressing the **[esc]**-key on the MDC.	
	Example:	Input:	SVALVE:AOPENS2

		Result:	The system launches a dispensing cycle, using the parameters given by the selected setup (or scenario; for further information about scenarios and the select pins, see paragraph 7.9, page 74).
		Return:	50,20,20,80,1,10

67	**WRITE:LCD:<text> (LCD = Liquid-crystal display)**		
	Description:	With this command, an ASCII text including up to 32 characters can be written on the screen. All the letters appear in form of capital letters.	
	Example:	Input:	WRITE:LCD:Hello World
		Result:	The display shows: HELLO WORLD
		Return:	OK

68	**TAPPET:SET:<value>**		
	Description:	This command allows you to decide on the number of cycles until the next tappet maintenance. If no numerical selection is made, the value will be “infinite”.	
	Example:	Input:	TAPPET:SET:500000
		Result:	500000 cycles have been selected.
		Return:	OK

69	**TAPPET:CLEAR**		
	Description:	The counter for tappet maintenance is cleared. This command is usually entered at the end of the maintenance procedure.	
	Example:	Input:	TAPPET:CLEAR
		Result:	Counter reset to “0”.
		Return:	OK

70	**NOZZLE:SET:<Value>**		
	Description:	This command determines the number of cycles to be performed until the next maintenance of the nozzle insert. If you do not enter any number, the value is set as “infinite”.	
	Example:	Input:	NOZZLE:SET:500000
		Result:	500000 cycles have been selected.
		Return:	OK

71	**NOZZLE:CLEAR**		
	Description:	The content of the nozzle maintenance counter is erased.	
	Example:	Input:	NOZZLE:CLEAR
		Result:	Counter reset to “0”.
		Return:	OK

72	**SCENARIO:STATUS**		
	Description:	This command tells if scenarios are “ON” or “OFF”. It also gives this information for the four PLC-Stops.	
	Example:	Input:	SCENARIO:STATUS
		Result:	Gives the ON/OFF status for scenarios and the four PLC-Stops.
		Return:	Scenario: OFF PLCSTOP Scenario 1: OFF PLCSTOP Scenario 2: OFF PLCSTOP Scenario 3: OFF PLCSTOP Scenario 4: OFF

73	**SCENARIO:OFF**		
	Description:	This command deactivates the use of scenarios.	
	Example:	Input:	SCENARIO:OFF
		Result:	Use of scenarios is deactivated.
		Return:	OK

74	**SCENARIO:ON**		
	Description:	This command activates the use of scenarios.	
	Example:	Input:	SCENARIO:ON
		Result:	Use of scenarios is activated.
		Return:	OK

75	**SCENARIO:PLCSTOP:<Scenario no.>:OFF**		
	Description:	This command deactivates the PLC-Stop. The number of the scenario can be either 1, 2, 3 or 4.	
	Example:	Input:	SCENARIO:PLCSTOP:1:OFF
		Result:	PLC-Stop for scenario 1 is deactivated.
		Return:	OK

76	**SCENARIO:PLCSTOP:<Scenario no.>:ON**		
	Description:	This command activates the PLC-Stop. The number of the scenario can be either 1, 2, 3 or 4.	
	Example:	Input:	SCENARIO:PLCSTOP:1:ON
		Result:	PLC-Stop for scenario 1 is activated.
		Return:	OK

77	**SCENARIO:SAVE:<Scenario no.>:<Segment 1 Setup, Segment 1 Number of Pulses, Segment 1 Scenario-Delay, Sg. 2 Setup, Sg. 2 NP, Sg. 2 Dl., Sg. 3 Setup, Sg. 3 NP, Sg. 3 Dl., Sg. 4 Setup, Sg. 4 NP, Sg. 4 Dl., Sg. 5 Setup, Sg. 5 NP, Sg. 5 Dl., Sg. 6 Setup, Sg. 6 NP, Sg. 6 Dl., Sg. 7 Setup, Sg. 7 NP, Sg. 7 Dl., Sg. 8 Setup, Sg. 8 NP, Sg. 8 Dl., Sg. 9 Setup, Sg. 9 NP, Sg. 9 Dl., Sg. 10 Setup, Sg. 10 NP, Sg. 10 Dl.>**		
	Description:	This command saves the parameters of the given scenario. You only have to enter parameters for the segments actually used. For every such segment, you have to give the setup number, the number of pulses and the scenario delay. The parameters will be checked. Not enough parameters or illegal ones will result in cancellation. Therefore, you always have to enter complete segments with setup number, NP and Sc. delay. You can enter a maximum of ten segments. The scenario number can be 1, 2, 3 or 4, a setup number 0, 1, 2 or 3. The NP can be between 1 and 32000 or 0, which would mean “infinite”. The scenario delay will be given in 1/10 ms, i.e. 5 means 0.5 ms. The max delay is 1000.0 ms, min delay is 0.1 ms. To delete a scenario use the version SCENARIO:SAVE:<scenario no.>:-.	
	Example:	Input:	SCENARIO:SAVE:1:0,1,5,1,2,5,2,3,5,3,4,5,0,5,5,1,6,50,2,7,50,3,8,50,0,9,50,1,10,50
		Result:	The scenario parameters of scenario 1 are saved.
		Return:	OK

78	**SCENARIO:READ:<scenario no.>**		
	Description:	This command gives you the scenario parameters of the named scenario via the serial interface. The response follows the scheme “setup no. of segment 1, number of pulses of segment 1, scenario delay of segment 1, setup no. of segment 2, NP of segment 2, sc. delay of segment 2, …, sc. delay of segment 10”. The scenario delay is given in 1/10 ms. The value 50 e.g. represents 5 ms. Only the used segments of the scenario are given, the others are left out in the output. **Information!** If a scenario is completely empty (e.g. after a factory reset), the response will be “Scenarioempty”.	
	Example:	Input:	SCENARIO:READ:1
		Result:	Gives the scenario parameters of scenario 1.
		Return:	0,1,5,1,2,5,2,3,5,3,4,5,0,5,5,1,6,50,2,7,50,3,8,50,0,9,50,1,10, 50

79	**SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>**		
	Description:	This command saves the given parameters in a setup. You always have to provide the number of the setup and all six setup parameters. All parameters will be checked. Not enough parameters, delay too short with activated heater or incorrect values will lead to cancellation. Parameters relating to time have to be specified in 1/10 ms, except for “Falling” and “Rising”, which have to be entered in 1/100 ms. Values lower than “1” are not admissible, only the open time can be “0”. Therefore, the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 70). Specified values must be integer and positive	
	Example:	Input:	SETUP:ASAVE:1: 30,10,15,80,20,15

		Result:	The parameters will be saved in the given setup and checked.
		Return:	OK

80	**SETUP:AREAD:<setup no.>**		
	Description:	This command reads the parameters of a given setup. As value you have to enter its number. All values relating to time, except “Falling” and “Rising”, are given in 1/10 ms (i.e. 10 ≙ 1 ms). Falling and rising are given in 1/100 ms (i.e. 100 ≙ 1.00 ms). Therefore, the minimum falling value amounts to 0.01 ms, the minimum rising value is 0.01 ms. But the minimum values for Falling and Rising also always depend on the current Needle Lift % (see paragraph 7.4 "Minimum and Maximum Parameter Limits", page 70).	
	Example:	Input:	SETUP:AREAD:1
		Result:	Displays the parameters of the given setup. Rising: 30 ≙ 0.3 ms (ms = Milliseconds) Open Time: 10 ≙ 1.0 ms Falling: 15 ≙ 0.15 ms Needle Lift: 80 % Number of Pulses: 20 Delay: 15 ≙ 1.5 ms
		Return:	30,10,15,80,20,15

81	**BAUDRATE:0/1/2/3/4**		
	Description:	This command changes the baud rate of the serial interface. There are five possible baud rates (9600, 19200, 38400, 57600 and 115200), corresponding with the parameters in this order (0, 1, 2, 3 or 4). **Important Note!** After reading the “OK”, the sender has to switch his baud rate as well; otherwise, the communication will break down.	
	Example:	Input:	BAUDRATE:1
		Result:	The baud rate is switched to 19200.
		Return:	OK

82	**GETTD**	**GETTD = Get time and date**	
	Description:	This command tells you the current time (UTC) and date in the format “hour, minute, second, year, month, day”.	
	Example:	Input:	GETTD
		Result:	The time (UTC) is given, including the date.
		Return:	10,07,00,2019,02,17 or No Clock (if the RTC of the MDC is defect)

83	**MDC:RESTART**		
	Description:	This command tells the MDC to shut down (without shutting down the power) and then to restart.	
	Example:	Input:	MDC:RESTART
		Result:	The MDC is shut down and then restarts.
		Return:	OK

8.2 PLC-Interface: 15-pin, Sub-D

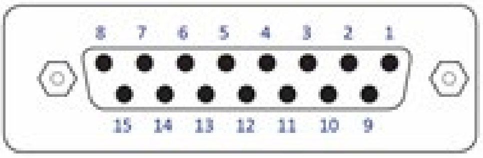


Fig. 66: PLC-Interface: 15-pin, Sub-D

The PLC-interface (illustrated above) works on digital basis without a particular syntax. It allows for controlling a machine or device by means of a remote master device. Transmission of data is possible in either direction. The trigger delay of this interface amounts to 120 µs.

Access is possible to:

- Status bits
- Values of voltage and current
- Set-Trigger signals initiating dispensing cycles (pulses) or complete packages of pulses (bursts)

You can find a connection diagram in the attachments (see paragraph 14.4, page 184).

INFORMATION

Do not use keypad during PLC triggered dispensing

When a PLC-trigger is send, the keypad is locked at the same time. This lock can be lifted by pressing the **[enter]**-key. But make sure not to do it during dispensing, since it also activates a delay, which could affect your dispensing result. On the other hand, a trigger does not work, if the MDC is not switched to the main menu. Additionally do not send a trigger, while the heater is starting.

8.2.1 Pin Functions

PIN	Characteristics	Level	Function
1	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	SingleDosOK
2	Input	0 / +24 V Ri=1.3 kΩ	Trigger Voltage Input 0 ... +5 V "Valve closed" +12 V ... +30 V "Valve opened" Positive edge triggering
3	Input	0/ +5 V Ri=400 Ω	Trigger Voltage Input 0 ... +0.8 V "Valve closed" +3 V ... +5 V "Valve opened" Positive edge triggering
4	Ground	___________	Ground
5	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	Set point Heating OK
6	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	Nozzle unit "adjusted" OK (means green adjust LED)
7	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	Mains voltage OK
8	Reserved	___________	___________
9	Output	24 V/50 mA	Power supply to external trigger
10	Ground	___________	Ground
11	Input	0 / 20 mA, Ri=500 Ω	Trigger Current Input
12	Reserved	___________	___________
13	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	For adjust: adjust failed. Adjust screw screwed in too deep or not enough. Outside adjust: general error (24 V = error)
14	Output	0 / +24 V, Ra=2.2 kΩ (valid for 0 V)	DosOK – Ready for dispensing (in the case of a pulse package, at the end of the entire burst)
15	Input	___________	Trigger Abort; connection to ground, to interrupt dispensing cycle; trigger blocked while active

8.2.2 PLC-Signals

The following graphs show you the different PLC-signals Trigger, DosOK and SingleDosOK and their behavior in various dispensing modes. The last paragraph then shows the effect of scenarios. It also shows the differences for the variants of DosOK (Delay ON and Delay OFF) and SingleDosOK (pulse and setup).

DosOK

The signal DosOK shows the length of a dispensing burst. During the pulsing burst, the signal is “low”.

SingleDosOK

The signal SingleDosOK shows, that a single shot is being dispensed. When the signal changes to “low”, a single shot is started. When the signal jumps back to “high”, it shows that the Open Time has ended and the valve is closed.

8.2.2.1 Single-Shot Mode

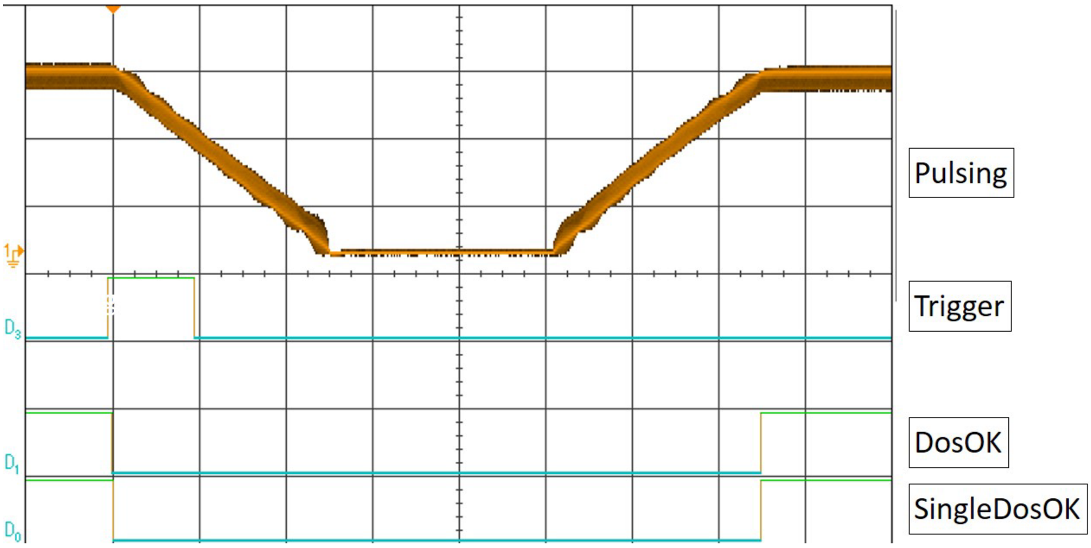


Fig. 67: Single-Shot Mode

8.2.2.2 Burst Mode (Example with Three Shots)

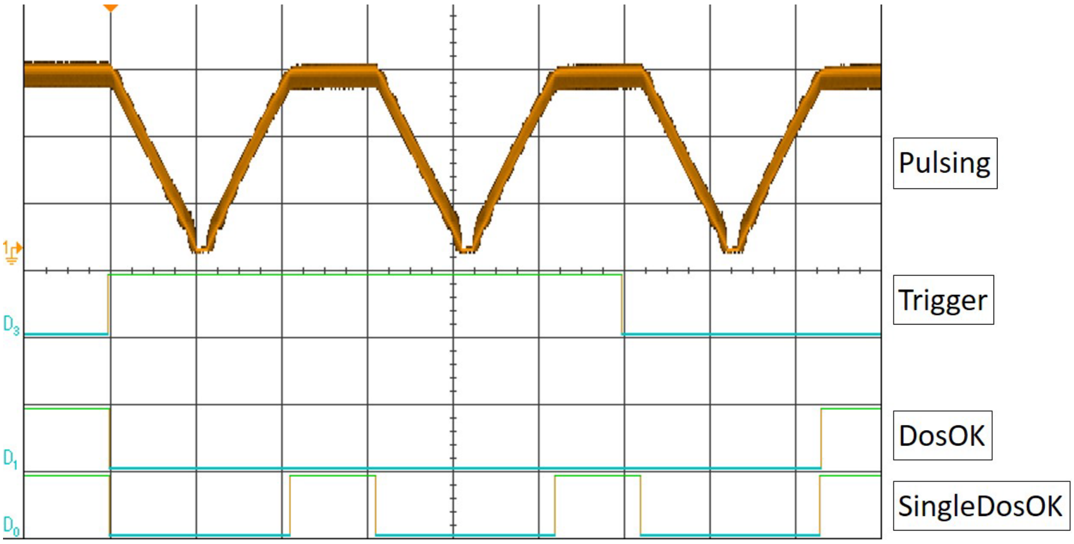


Fig. 68: Burst Mode (Example with Three Shots)

8.2.2.3 External Mode

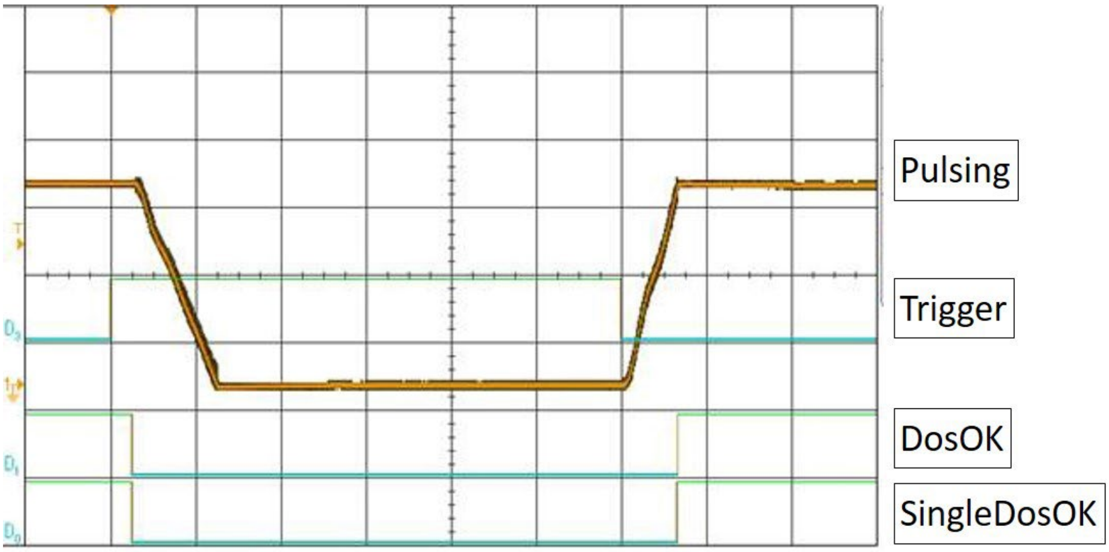


Fig. 69: External Mode

8.2.2.4 Infinite Mode

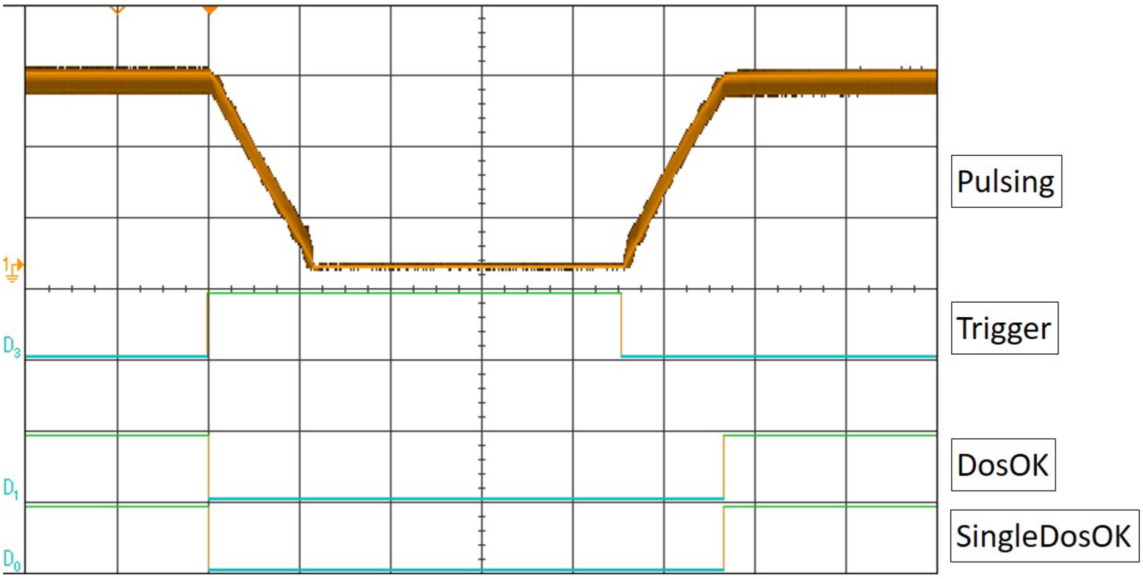


Fig. 70: Infinite Mode

8.2.2.5 Comparison of the signals DosOK and SingleDosOK for Scenario ON and Scenario OFF

The following two figures show the signals DosOK and SingleDosOK in relation to the tappet movement. In the first figure, scenarios are off, in the second figure, scenarios are ON.

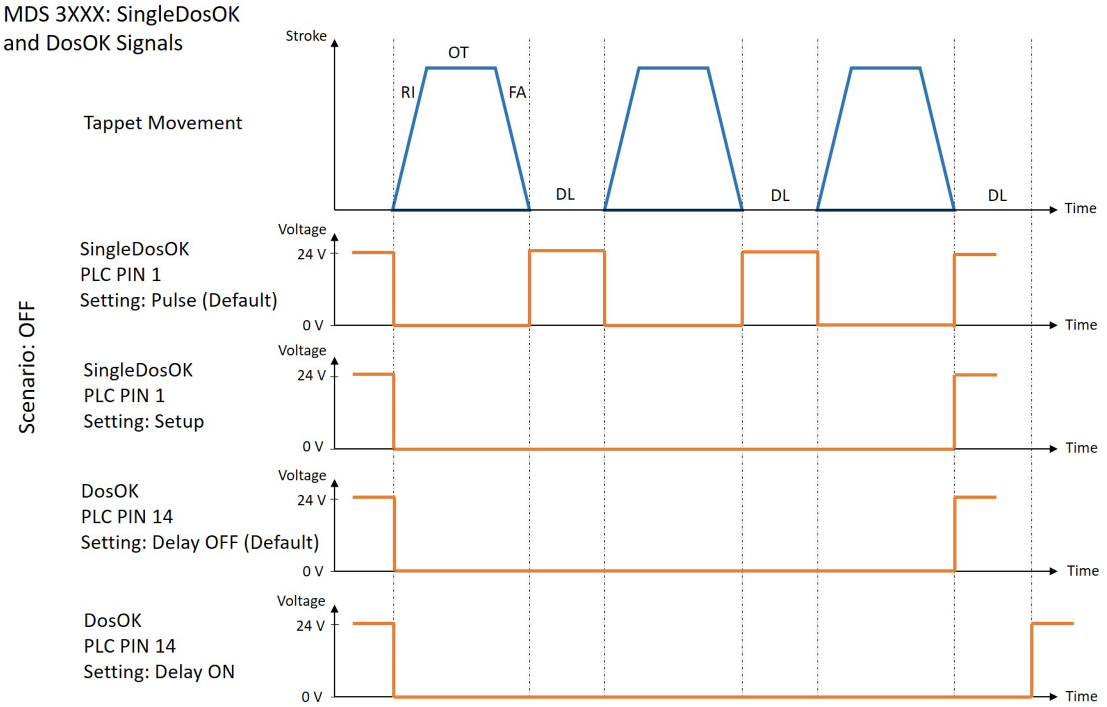


Fig. 71: PLC signals with Scenario OFF

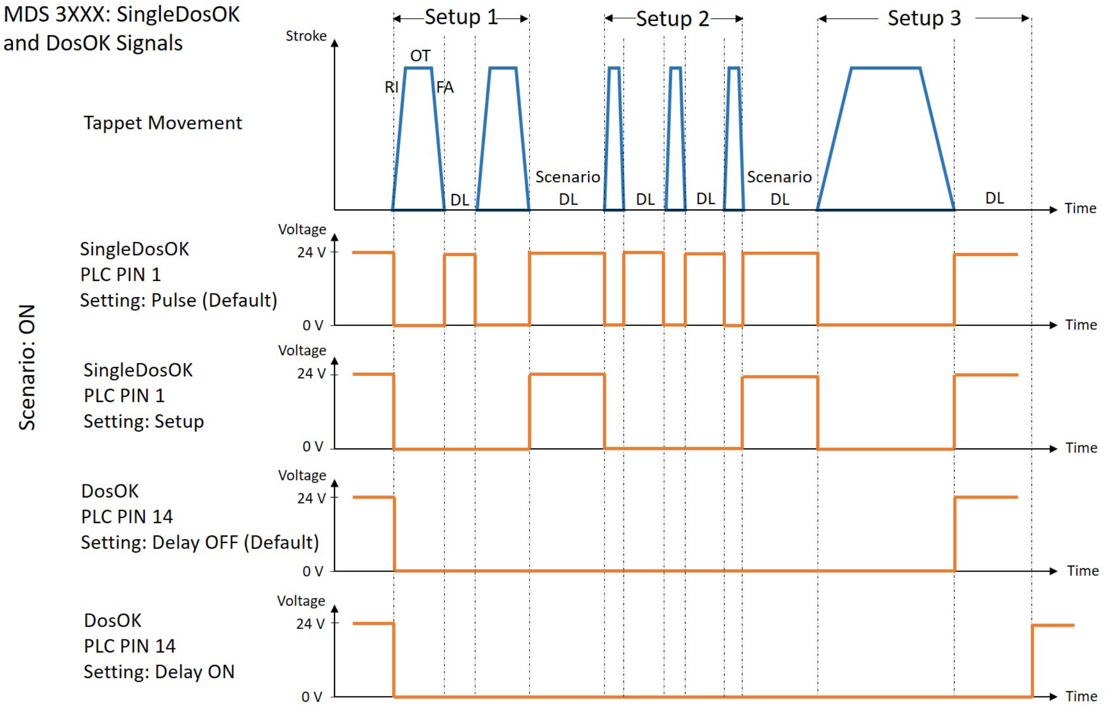


Fig. 72: PLC signals with Scenario ON

8.2.3 Remote Adjust

8.2.3.1 What is the Remote Adjust?

A remote adjust is similar to a normal adjust (see paragraph 6.5, page 60), but the system is operated from a master device (e.g. a PC or an XY machine) by means of interfaces (PLC, RS-232C). The function itself is identical.

8.2.3.2 Advantages

The remote adjust allows for total control of an MDC integrated in a machine, since dispensing parameters can be monitored by the software of this machine. The control unit can be built in with permanent key lock. Thus the modification of parameters without authorization can be prevented in the machine software.

8.2.3.3 Procedure

The remote adjust has to be performed according to the following instructions:

IMPORTANT NOTE

Heating and remote adjust

In case your application uses a nozzle heater, you have to activate the heater before you start the adjust. Make sure to wait long enough for the heater to reach stable temperature, since the adjust could lead to an incorrect result otherwise.

While the heater is still heating up (red heater-LED is flashing), the messages “Please wait for the heating!” and “Or ESCAPE for Adjust!” appear alternating on the display. Once the necessary temperature is reached, the message “You can now start Adjust!” appears.

(If necessary, you can start the Adjust ahead of time by sending a long trigger signal (110 ms – 200 ms) via PLC-interface to your controller during the heating phase, but you should be aware of the consequences for the accuracy of the Adjust.)

Wear heat-resistant gloves while working with the valve!

INFORMATION

Displaying remote adjust

- In the beginning of the remote adjust, both adjust LEDs are lit simultaneously.
- The display of the MDC shows “Remote Adjust is running!”
- For transmission of the orders between PC and control unit, the interfaces RS-232C and PLC-interface are used.

INFORMATION

Preparation before remote adjust

- Screw the nozzle fixation nut absolutely tight (torque at least 150 cN.m).
- The baud rate of the serial interface needs to be set to 115200.

1. Send the command “ADJUST:START” to the control unit via RS-232C. The system returns the message “Adjust Screw OUT Press Enter”. Screw open the adjust screw completely (counter-clockwise, see Fig. 73, page 133, torque for screwing it open is approx. 50 – 60 cN.m).

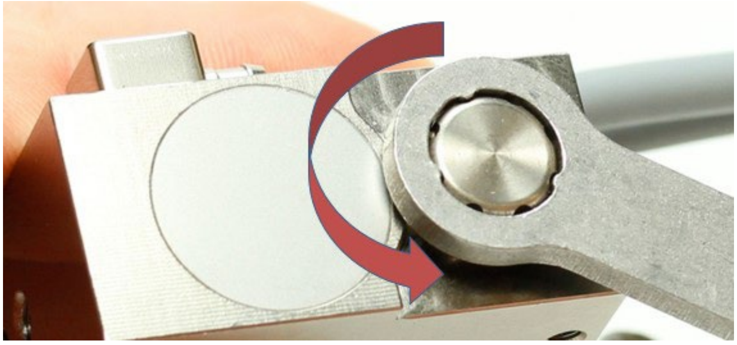


Fig. 73: Screw open adjust screw

2. In order to confirm step 1, send a short trigger signal (500 µs – 80 ms) to the control unit via PLC interface.

   Short trigger signal:

- 5 V or 24 V (PIN2 + PIN4 or PIN3 + PIN4 Input signal of MDC via 15 pin Sub-D)
- Signal length: 500 µs – 80 ms

3. The system jets 500 shots to clear the valve for the remote adjust. The message “500 Shots Please Wait” is shown. Then the message “Please wait…” appears.

INFORMATION

Adjust offset during 500 shots

In case you have an adjust offset activated, when you start the adjust, both adjust LEDs will blink during the 500 shots. At the same time, the adjust offset value is shown in the display.

INFORMATION

Support information for older valves

In exceptional cases, older valves may display the message “Please contact support for further information!” at this point. In this case, please contact the technical support of VERMES Microdispensing (see Page 7). They will explain how to proceed with this valve.

4. The message “Adjust Screw IN until GREEN LED ON” appears first. Then the message alternates with “SLOW-SCREW IN until green LED ON”. The system then returns the current status of the adjust LEDs, continuously repeating the transmission to the PC in intervals of 500 ms (via RS-232C). An additional command to update the status of the adjust LEDs on the screen is not required.
5. Turn the adjust screw inwards (clockwise), until the message displayed on the PC is changed to “Adjust LED GREEN press enter”. The green adjust LED on the MDC is lit.
6. In order to confirm the remote adjust, send a short trigger signal (500 µs – 80 ms) to the control unit via PLC interface (see Step 2). This will only be accepted, if the message “Adjust LED GREEN press enter” is shown. After the confirmation, the system then returns the following response via RS-232C: “Adjust Success”.

   The remote adjust has been completed successfully.

In case you had turned the adjust screw too far, the message “Adjust LED RED Adjust Screw OUT” appears. Turn the adjust screw outwards (counter-clockwise), until the message “Adjust LED GREEN press enter” appears. From there, screw further back, until the message disappears. Then screw back in, until the the message “Adjust LED GREEN press enter” appears again. Confirm the remote adjust as described (see Step 6).

The remote adjust can be aborted anytime by sending a long trigger signal (110 ms – 200 ms) to the control unit via PLC- interface. The system returns the message “Adjust failed” to the PC.

Long trigger signal:

- 5 V or 24 V (PIN2 + PIN4 or PIN3 + PIN4 Input signal of MDC via 15 pin Sub-D)
- Signal length: 110 ms – 200 ms

8.3 AUX socket

The AUX socket can be used for the supply of an external device (e.g. an optocoupler) or to control certain setups (see paragraph 7.8, page 72) or scenarios (see paragraph 7.9.3, page 75). The pin assignments are shown below (see Fig. 74). In case the select pins are activated, the maximum current is 12 mA. The other pins are used internally and cannot be used otherwise. The socket is a Lumberg SV81 8P.

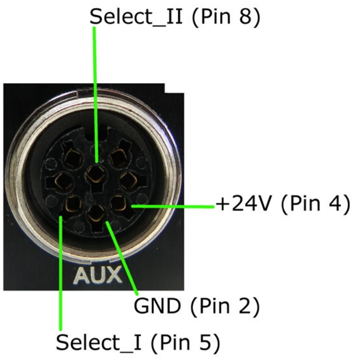


Fig. 74: AUX socket

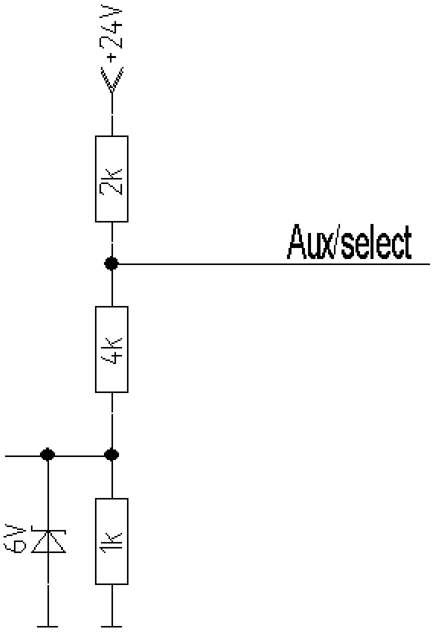


Fig. 75: Circuit diagram

9 Cleaning

After every dispensing process involving aggressive or self-curing substances, a cleaning procedure is recommended. It should involve the valve and all other surfaces in contact with the fluid. Different methods of cleaning are described in the following chapter. The proper choice depends on the degree of contamination and the dispense medium used.

9.1 Preliminary Notes

IMPORTANT NOTE

Prepare cleaning in advance

It is recommended to prepare the cleaning procedure in advance. Do not drop the device or its subcomponents.

⚠ **CAUTION**

Liquid spurts possible

Residual liquids may spurt when handling components during the cleaning process. Therefore, protective clothes are recommended:

- Safety goggles
- Gloves (chemical resistant)
- Overall (chemical resistant)
- Surgical mask

Remember that the surface of the valve is sensitive to abrasion, so do not use wire brushes and other inappropriate tools. A specially developed cleaning tool kit (CTK 2.5) is available upon request (order no. 1014632), which is of particular interest for all surfaces in direct contact with the fluid.

⚠ **WARNING**

Potential chemical reaction!

The dispensed medium and the cleaning agent must be compatible to each other. Otherwise, they might cause unwanted chemical reactions, toxic vapor, increase of temperature etc. Consult the manufacturer in case of doubt.

Before introducing aggressive purifying agents or solvents to the system, verify compatibility with the material of all adjacent parts. Refer to the list in paragraph 9.3, page 138.

In case of materials you cannot find on the list, please consult the manufacturer or the Technical Support of VERMES Microdispensing (see Page 7).

⚠ **CAUTION**

Keep actuator clean

No liquid may penetrate into the actuator (e.g. through the plug); otherwise the whole element could be damaged.

9.2 Heat Resistance of Sealing Materials

The following table shows the maximum temperature to which the respective sealing materials may be exposed.

Material	Max. Temperature [in °C]
PE	80
PTFE	230
NBR	100
EPDM	140
Silicone	200
Viton	220
CeTeDur	250

Tab. 28: Heat Resistance of Sealing Materials

9.3 Compatibility between Sealing Materials and Selected Media

	NBR	EPDM	VITON	SILICONE	PE	PTFE	CeTeDur
Acetone	---	+++	---	- +	+++	+++	+++
Ammonia	---	---	---	+++	+++	+++	+++
Chloroform	---	---	+++	---	+++	+++	+++
Cyclohexane	+++	---	+++	---	+++	+++	+++
Cyclohexanol	+++	---	+++	- +	+++	+++	+++
Cyclohexanone	---	---	---	---	---	+++	+++
Dimethylformamide	---	+++	---	- +	+++	+++	+++
Acetic acid	---	---	---	- +	+++	+++	+++
Ethanol	+++	+++	---	+++	+++	+++	+++
Heptane	+++	---	+++	---	- +	+++	+++
Hexane	+++	---	+++	---	- +	+++	+++
Isopropanol	- +	+++	+++	+++	+++	+++	+++
Methylene Chloride	---	---	- +	---	---	+++	+++
Nitromethane	---	- +	---	---	+++	+++	+++
Pentane	+++	---	+++	---	---	+++	+++
Mercury	+++	+++	+++	+++	+++	+++	+++
Silicone Oil	+++	+++	+++	- +	+++	+++	+++
Toluene	---	---	---	---	- +	+++	+++
Water	+++	+++	+++	+++	+++	+++	+++
Xylene	---	---	+++	---	- +	+++	+++
Legend							
Excellent compatibility +++	No or only a marginal influence on the component.						
Moderate compatibility - +	Limited contact and sporadic exposure to the media will allow some usability, but long term it will lead to malfunctions of the component. If possible, use materials with a higher compatibility.						
No compatibility ---	Usage is not recommended.						

Tab. 29: Compatibility between Sealing Material and Selected Media

9.4 Cleaning Methods

The following methods are available:

- Pre-purifying
- Rinsing with a purifying agent
- Total disassembly of the valve, followed by fine purification

For a thorough cleaning process, you need:

- A cleaning tool kit CTK 2.5
- Nozzle insert cleaning wires (of the correct size)
- A lint-free cloth
- An ultrasonic bath
- A beaker with a compatible cleaning liquid (e.g. Isopropanol)
- A pointed pair of tweezers
- The necessary tools for mounting and demounting as recommended by VERMES (see paragraph 3.3, page 15).

9.4.1 Pre-purifying

Pre-purifying consists in purging the system with compressed air.

⚠ **CAUTION**

Potential liquid spurts

During this procedure, liquid droplets may be expulsed!

Users must protect themselves correspondingly (protective clothing, safety goggles).

Step 1:

– Complete the dispensing process. The valve is in closed position.
  Do NOT switch OFF the control unit.

Step 2:

– Separate the compressed-air connection.
– Reduce the pressure to 0 bar.
– Disconnect the PP adapter fitting from the cartridge.

Step 3:

– Replace the used cartridge by a new one.

Step 4:

– Reinstall the compressed-air connection as follows.
– Place the PP adapter fitting on the cartridge. Rotate clockwise, until it latches in place.
– Connect the PVC hose with the KS4-CK-6 coupler plug to a compressed-air supply. For this purpose, you require a KD4-1/2-A coupler socket.
– Activate the compressed-air supply.

Step 5:

– Place a container underneath the valve, to collect any liquid dripping out.

Step 6:

– Initiate the purging procedure by pressing **[F1]**.
– Keep the **[F1]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle unit.

INFORMATION

Automatic closing

After ca. 2 min the valve closes automatically, in order to protect the actuator.

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands VALVE:UP and VALVE:DOWN for this purpose.

Step 7:

– Separate the compressed-air connection and remove the cartridge.

Step 8:

– Make sure the collected liquid in the container is disposed of according to local regulation.

9.4.2 Rinsing with a purifying agent

After pre-purification by compressed air, residual liquid may still be present inside the fluid system (particularly when dispensing high-viscous substances). It can only be removed by a flushing procedure. For this purpose, the following examples may be suitable agents:

- Distilled water
- Ethanol
- Isopropanol (IPA)
- Acetone

⚠ WARNING

Potential chemical reactions

Before the start of the procedure, carefully read the safety data sheet of the dispensed substance. Ensure compatibility with the cleaning agent.

The cleaning agent itself should not react with any part in contact with the fluid.

Consult the manufacturer in case of need, especially if you intend to use aggressive material.

Step 1:

– Complete the dispensing process. The valve is in closed position. Do NOT switch OFF the control unit.

Step 2:

– Separate the compressed-air connection.

– The pressure must be reduced to 0 bar.

– Disconnect the PP adapter fitting from the cartridge.

Step 3:

– Replace the used cartridge by a new one.

– The purifying agent can be supplied.

⚠ CAUTION

Check for leaks

All of the connectors must be installed and leak-tight.

Step 4:

- Reinstall the compressed-air connection as follows.
- Place the PP adapter fitting on the cartridge. Rotate clockwise, until it latches in place.
- Connect the PVC hose with the KS4-CK-6 coupler plug to a compressed-air supply. For this purpose, you require a KD4-1/2-A coupler socket.
- Activate the compressed-air supply.

Step 5:

- Place a container underneath the valve, to collect any liquid dripping out. The container needs sufficient capacity to contain the purifying agent together with the solved residual liquid.

Step 6:

- Initiate the purging procedure by pressing **[F1]**.
- Keep the **[F1]**-key pressed until the procedure is complete and no more liquid flows out through the nozzle unit.

INFORMATION

Automatic closing

After ca. 2 min the valve closes automatically, in order to protect the actuator.

Alternatively, the procedure can be performed by the RS-232C interface. Use the commands VALVE:UP and VALVE:DOWN for this purpose.

Step 7:

- Separate the compressed-air connection and remove the cartridge.

Step 8:

- Make sure the collected liquid in the container is disposed of according to local regulation.

9.4.3 Demount the Valve

⚠ CAUTION

No dispensing medium residues

Before demounting the fluid box from the valve, make sure that no dispensing medium is left inside the system.

Preliminary steps:

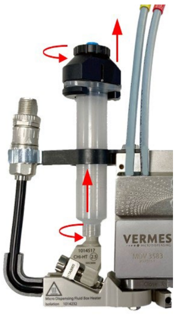
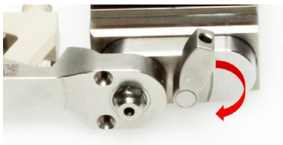
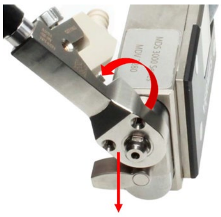
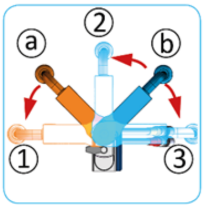
- The dispensing process must be completed. The valve is in closed position.
- Deactivate the compressed air supply.
- Switch OFF the control unit and disconnect it from the mains.
- Remove the actuator cable and sensor cable from the valve.
- Detach the valve with fluid box from dispensing robot.

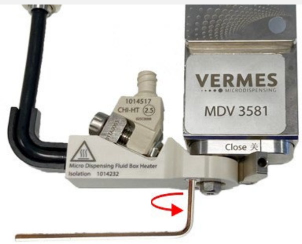
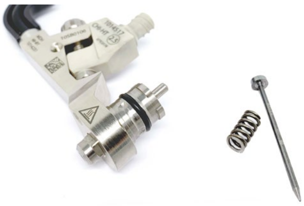
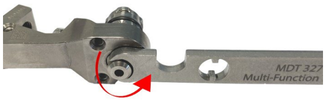
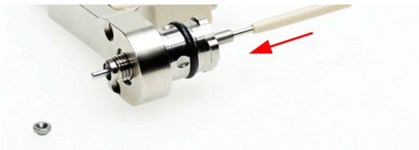
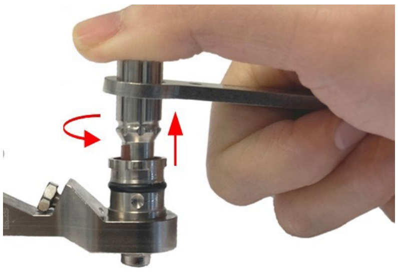
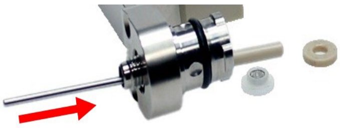
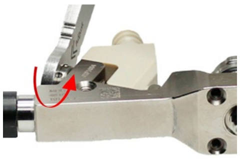
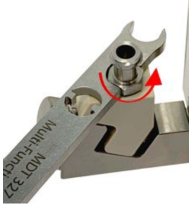
⚠ CAUTION

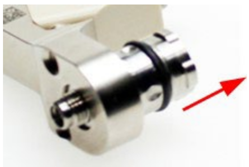
High temperatures, danger of burns

Be careful if you have used a heater with your application. A nozzle heater can reach temperatures of up to 180 °C. Do not touch this area before it has cooled, since there is the danger of severe burns. Use heat resistant gloves.

Disassemble the valve as follows.

	**Step 1 (compressed air adapter and cartridge)** Screw open the compressed air adapter and then push it sideways off the cartridge. Unscrew and remove the cartridge. First unscrew the cartridge counter-clockwise, then pull it out.
	**Step 2 (fluid box)** Turn the locking lever by 180° from “Close” to “Open”.
	Turn the fluid box by 45° and pull it off from the valve.
	**Optional positions** The bayonet fluid box has three different locking positions (1: -90°, 2: 0°, 3: +90°) in which the valve can be operated. To open it from locking position 1, turn the fluid box to position a. To open it from locking position 2 or 3, turn the fluid box to position b.

 VERMES MDV 3581 Close Micro Dispensing Fluid Box Heater Isolation 1014232	**Optional (isolation body)** In case you have used an isolation body in your application, remove it from the fluid box. Unscrew the two screws for the isolation body (counter-clockwise). Use the MDT 329 – L-Shape Hexagon Key.
	**Step 3 (tappet rod and tappet spring)** Pull the tappet from the fluid box. Pull the tappet spring from the tappet rod.
	**Step 4 (nozzle fixation nut)** Remove the nozzle fixation nut by screwing counter-clockwise. You can use the MDT 327 - Multi-Function Tool or the MDT 307 - Adjust Tool TA Hotmelt Handle (with the correct Bit).
	**Step 5 (nozzle insert)** Use the thin end of MDT 323, to push out the nozzle insert from behind.
	**Step 6 (tappet centering screw)** Unscrew the Tappet Centering Screw BY from the fluid box (counter-clockwise). Use the MDT 303 - Nozzle Changing Tool. Make sure the three pins of MDT 303 fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 counter-clockwise while pressing it down slightly to the fluid box. Combine the MDT 303 with MDT 327 for a better leverage.
	**Step 8 (tappet sealing and tappet centering piece)** Push out the tappet centering piece and the tappet sealing from the fluid box. Use the thicker side of tool MDT 323. **Important note!** There is no tappet centering piece, if you use a 2G tappet rod.
	**Step 9 (cartridge base)** Unscrew the tightening screw with the help of the MDT 327 (counter-clockwise). Remove the tightening screw and the cartridge base from the fluid box.
	**Important note!** If you use a Cartridge Base CH, you need to screw off the Fluid Box Connector Luer Lock first. Use the open-jawed wrench at the side of the MDT 327 (hexagon screw size M8).

	**Step 10 (O-ring)** Remove the O-ring from the fluid box body. Pull it off carefully with a pair of tweezers. Be careful not to damage the O-ring. **Caution!** You could omit this step, only if the solvent you use is compatible with the material of the O-ring.
	Unusual (connector BY) Usually you will **not** remove the Connector BY and the fluid box body. In case the connector is clogged, use MDT 327 to screw off the Connector BY (counter-clockwise). Then pull out the fluid box body.

Tab. 30: Disassembling of the valve

⚠ CAUTION

Damaged tappet sealing

Only use the tools recommended by VERMES. Do **not** use a sharp tool to press the tappet sealing from the fluid box. It could cause damage to the tappet sealing, which might lead to a leakage.

9.4.4 Fine Purification

Preliminary steps:

- Push a cleaning rod or a fluidic brush through the media carrying channels of all the components.

First, clean the single components in an ultrasonic bath.

- Place a beaker in the ultrasonic bath. Make sure it is large enough.
- Place the nozzle insert, tappet sealing, tappet centering piece, cartridge base, tightening screw, nozzle fixation nut and the fluid box body in the beaker.

⚠ CAUTION

Damage of O-ring/tappet sealing

Unless the compatibility between the O-ring/Tappet sealing and the solvent is excellent, do not insert the O-ring/Tappet Sealing into the solvent.

⚠ CAUTION

Damage of components

Place tipped nozzle inserts (e.g. J-, C-, N27-type) in a separate beaker. To avoid damage, do not place tipped nozzle inserts together with other components in one beaker.

IMPORTANT NOTE

Keep heater connection dry

Make sure that the heater connection stays outside the beaker (see picture), to avoid any fluids reaching the electronics. (In case you do not use a heater and have the mounting body BY instead of an MDFH, you can ignore this part.)

- Fill the beaker with an appropriate solvent (e.g. Isopropanol), until all of the parts are covered.
- Leave the components for ca. 15 min inside.

⚠ WARNING

High temperature, danger of burns

Be aware of your dispensing medium when setting the temperature, if the dispensing medium is inflammable. Otherwise, with too high temperatures deflagration might occur. Set the temperature as low as possible within the effective range.

- Take the beaker with the components out of the ultrasonic bath. Then use tweezers to take the components out of the beaker.

Next, clean all components by hand.

- For fine purification, you have to clean all components by hand. In general, you should take special care about those places, which get in contact with the medium or where two different parts fit together. First, you should clean the nozzle insert, since hardening would cause most problems here.

INFORMATION

Simpler cleaning

For some uncomplicated media it is possible to clean the parts just by using a fluid like ethanol and compressed air, which can simplify the cleaning process. But before you try it, you should always contact our Technical Support.

INFORMATION

Nozzle inserts with small orifices

If a nozzle insert with orifices smaller than 100 µm (except for nozzle inserts with long dispensing channels, namely J-/C-series, N-27 and N-28) happens to be still clogged after cleaning, please clean it with MDT 316 - Nozzle Insert Cleaning Tool. For operating the MDT 316 please refer to the “Quick Reference Guide – MDT 316 - Nozzle Insert Cleaning Tool”.

Step 1 (nozzle insert)

Start with the nozzle insert. For the bore use a nozzle insert cleaning wire. These come with different sizes. They are not part of the cleaning toolkit CTK and have to be ordered separately.

Important note!
Use the MDT 324 - Nozzle Insert Cleaning Holder with all Vermes nozzle inserts. With it, you can safely keep the nozzle insert in place during cleaning and drying with compressed air.

Clean the surface of the inner channel using a fluidic brush. Clean it thoroughly from above and below with a cleaning rod.

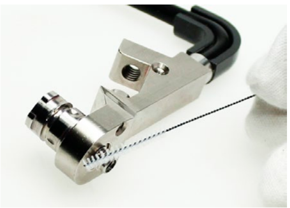
Step 2 (nozzle fixation nut)

Clean the nozzle fixation nut. Use a cleaning rod to clean the inside/outside of the nozzle fixation nut. Pay special attention to sharp corners and edges.

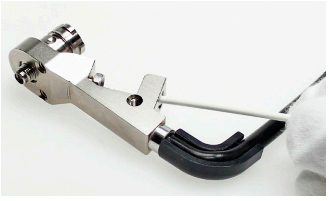
Push a fluid box cleaner through the opening of the nozzle fixation nut to remove persistent residues.

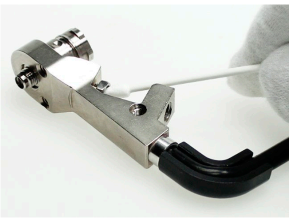
Clean the bore of the nozzle fixation nut using a fluidic brush.

Step 3 (fluid box body)



With the fluid box, clean all bores and threads with a fluidic brush first.

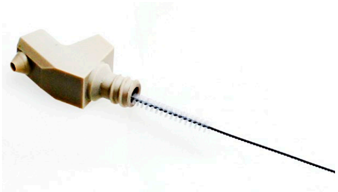
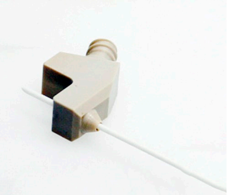




Afterwards, use a fluid box cleaner. Check all bores as well and then clean the rest of the fluid box body.

Step 4 (tappet centering screw)

Push the fluidic brush through the bore of the tappet centering screw first.

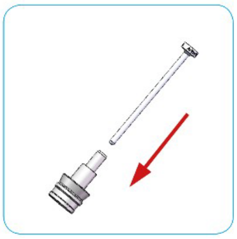
	Keep using the fluidic brush to clean the threads of the tappet centering screw.
	Afterwards, use a cleaning rod to clean the inner rim of the tappet centering screw. **Important note!** You need to perform a two finger seesaw test (see Tab. 32, page 149), to check if the tappet rod runs smoothly through the tappet centering screw. Otherwise, the parts have to be cleaned again.
	**Step 5 (cartridge base)** For the cartridge base, start with the fluidic brush to clean all bores and openings of the cartridge base.
	Next clear the bore with a cleaning rod. Finally use a fluid box cleaner to clean the wide opening of the bore. **Important note!** If you use a cartridge base without integrated luer lock, you need to clean the Fluid Box Connector Luer Lock as follows. Otherwise, you can continue with the next step.
	Push a cleaning rod through the bore of the Fluid Box Connector Luer Lock several times to remove any residues of the medium.
	Clean the center bore of the Fluid Box Connector Luer Lock using a fluidic brush.
	Clean the openings and thread of the Fluid Box Connector Luer Lock using a fluid box cleaner. Use it for the outside and the end of the bore.
	Step 6 (tappet sealing) For the tappet sealing, clean the bore of the tappet sealing carefully with a fluidic brush.
	Afterwards, clean the outside of the tappet sealing. Keep using the fluidic brush, especially for the outer edge.

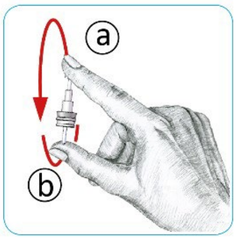
	Then clean the inner rim of the tappet sealing with a cleaning rod.
	Clean the outside of the tappet centering piece first with a lint-free cloth.
	Use a fluidic brush for the bore of the tappet centering piece. **Important note!** There is no tappet centering piece, if you use a 2G tappet rod.
	Step 7 (valve body) Clean the valve with a lint-free cloth.
	Step 8 (O-ring) Clean all O-rings with a lint-free cloth.

Tab. 31: Clean all components by hand

- Dry all the components in the air or with compressed air. For nozzle inserts we recommend to use the MDT 324 Nozzle Insert Cleaning Holder.

- A two finger seesaw test is necessary to check if the tappet rod runs smoothly through the tappet centering screw. Otherwise, the parts have to be cleaned again.

	**Step 1:** Push the Tappet Centering Screw BY onto the tappet rod.

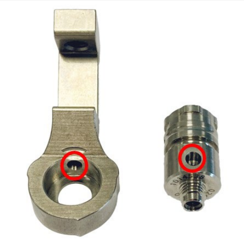
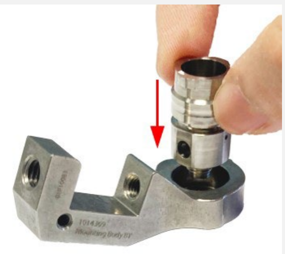
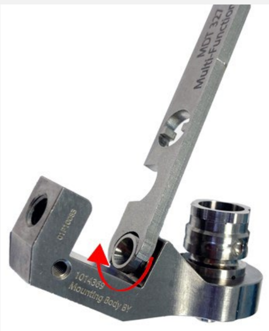
	**Step 2:** Hold the tappet rod with the Tappet Centering Screw BY between index finger and thumb. Swivel the tappet half-circularly between a and b. The Tappet Centering Screw BY must slide smoothly on the tappet rod in between the ends. Remove the tappet centering screw from the tappet rod after the test.

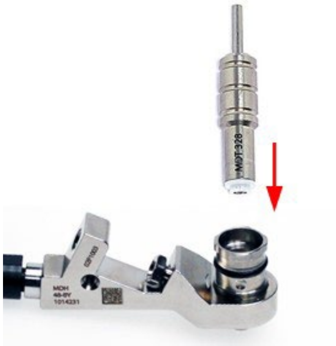
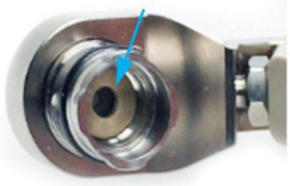
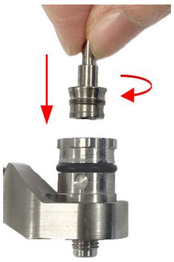
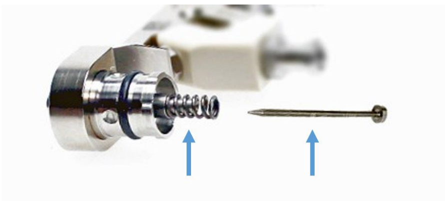
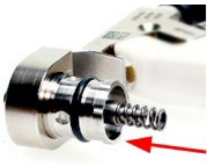
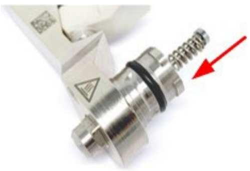
Tab. 32: Two-Finger-Seesaw-Test

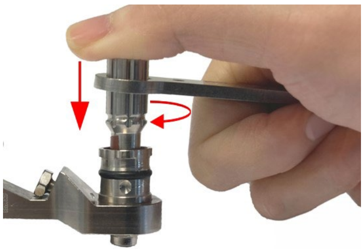
In case you still have parts which are not completely clean after the fine purification, repeat the corresponding cleaning steps for those components several times, if necessary. If that is still not helping, contact our Technical Support.

9.4.5 Assembling of the Fluid Box and the Tappet

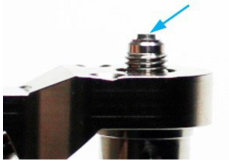
Re-assemble the valve and its components as follows.

  	**Unusual (connector BY)** In the exceptional case that you removed the connector BY as well, you have to mount it first. Place the fluid box body on the receptacle of the mounting body. Align the bore on the fluid box body with the bore on the mounting body (see circles). The fluid box body will fit into the mounting body, if the mounting direction is correct. Push the Connector BY through the mounting body into the bore of the fluid box body. Screw the Connector BY tight (clockwise) by using an MDT 327 (for newer revisions of the Connector BY you can also use a hexagon key 2.5 or the Torque Wrench Tool VM with the Bit Hexagon Key 2.5). Torques are depending on the material of the mounting body (stainless steel 120 – 140 cN.m, PEEK 70 – 80 cN.m). **Important Note!** Do not press the fluid box body while fastening the Connector BY, otherwise, it cannot correctly grip into the fluid box body.
	Step 1 (O-ring) In case that you removed the O-ring, you have to mount it onto the fluid box body. Pull the O-ring over the fluid box body with a pair of tweezers. Be careful not to damage the O-ring.

	**Step 2 (tappet sealing)** Use the MDT 328 - Tappet Sealing Changing Tool to press the Tappet Sealing PE/PTFE/HT into the fluid box body until it sits tight. When the tappet sealing sits tight, you will hear a light noise.
	**Step 3 (tappet centering piece)** Press the tappet centering piece into the fluid box. Use the MDT 328 to make sure the tappet centering piece rests flat on the tappet sealing. **Important note!** When using a 2G tappet rod, do not use a tappet centering piece.
	**Step 4 (tappet and tappet centering screw)** Screw the Tappet Centering Screw BY into the fluid box. Do not screw it tight yet. Screw it only for two rotations.
  	**Important note!** Before mounting, please place a small droplet of Tappet Grease TF (Order no. 1014637; droplet size ca. 2 mm) on the tappet and another on the tappet spring (for placing see blue arrows in the picture). Make sure that the tappet tip is free of grease. Rotate the tappet and pull it in and out for three times to spread the grease. Place the tappet spring over the Tappet Centering Screw BY. Push the tappet rod through the tappet spring into the Tappet Centering Screw BY. Make sure the tappet goes through the tappet sealing.

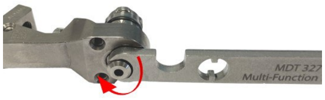


Screw the Tappet Centering Screw BY completely into the fluid box (torque 100 – 140 cN.m) with MDT 303 - Nozzle Insert Changing Tool.
Make sure the three pins of the MDT 303 fit exactly into the three holes of the Tappet Centering Screw BY. Turn the MDT 303 clockwise while pressing it down slightly to the fluid box.
Combine the MDT 303 with MDT 327 for a better leverage.



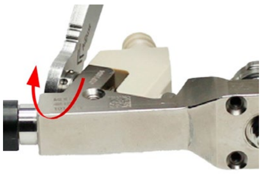
Step 5 (nozzle insert)

Clip the nozzle insert into the fluid box. Use the small hole of MDT 327 to press the nozzle insert. Make sure the nozzle insert sits flat.



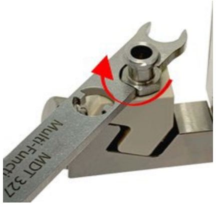
Step 6 (nozzle fixation nut)

Screw the nozzle fixation nut clockwise onto the fluid box. Use the MDT 327 - Multi-Function Tool (torque 150 – 180 cN.m).

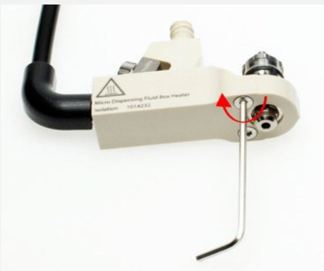


Step 7 (cartridge base)

Place the cartridge base onto the fluid box and fix it with the tightening screw. Screw the tightening screw clockwise with MDT 327 Multi-Function Tool (torque 120 – 140 cN.m).

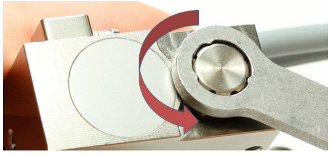


Important note!
In case you use a cartridge base without integrated luer lock, you need to screw the Fluid Box Connector Luer Lock into the top bore of the cartridge base CH. Use the open-ended wrench at the side of the MDT 327 (hexagon screw size M8, torque stainless steel 100 – 120 cN.m, PEEK 40 – 60 cN.m).



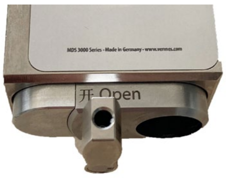
Optional (isolation body)

For thermally sensitive applications, you might use an isolation body. Pull it onto the fluid box, until it clips in. Screw it tight with the two screws for the isolation body (torque 40 – 50 cN.m). Use the tool MDT 329.



Step 8 (adjust screw)

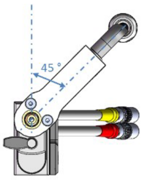
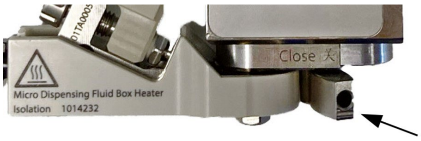
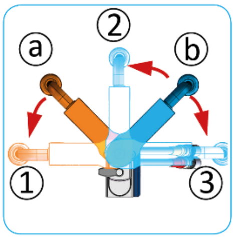
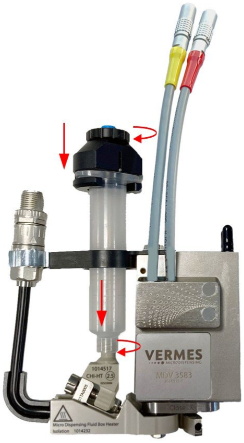
Open the adjust screw completely. Screw counter-clockwise. Use the MDT 327 Multi-Function Tool.



Step 9 (fluid box)

Turn the locking lever by 180° from “Close” to “Open” position.

Push the fluid box carefully in a 45° angle onto the valve.

  Close Micro Dispensing Fluid Box Heater Isolation 1014232	Straighten the fluid box and close the locking lever.
	**Optional positions** The bayonet fluid box has three different locking positions (1: -90°, 2: 0°, 3: +90°) in which the valve can be operated. To fix in locking position 1, mount the fluid box at position a. To fix in locking position 2 or 3, mount the fluid box at position b.
	**Step 10 (cartridge and compressed air adapter)** Push the cartridge through the cartridge holder and screw it clockwise into the thread of the cartridge base. Finally, push the compressed air adapter onto the cartridge and screw it tight.

Tab. 33: Assembling of the valve

- Finally, connect the actuator and sensor cables as well as the compressed air. You can find more detailed information in paragraph 6.2, page 48and paragraph 6.3, page 52.

10 Maintenance

10.1 Maintenance Indicator

The integrated function “Cycle Count” relates to the valve as a whole and is predetermined by the manufacturer. As soon as the preset number of cycles is complete (100 %), the red maintenance LED on the control panel is lit. The manufacturer (or an authorized subcontractor) has to be informed at once.

In between, you can inspect the current state. Use the function “Maint. Cycle” in the submenu “Status” (see paragraph 4.5.4, page 34). The result is visualized by eight bars on the screen, each of them representing 12.5 % of the final value. Be aware that the bar is only updated during a start-up of the MDC.

INFORMATION

Suppress maintenance messages

Activation of the red maintenance LED can be suppressed by switching “Maint. Message” in the submenu “Status” to “OFF”. This should only be done, if you know your system very well. Otherwise, you might cause damages through missed maintenance dates.

Additional cycle numbers can individually be agreed for tappet and nozzle insert. In factory settings, the value of “Infinite” is assigned to both of the targets. If you wish to check a particular value, proceed as follows, starting from the first menu level:

- 1x **[→]**-key = Indicates the interval for exchange of the nozzle insert
- 2x **[→]**-key = Indicates the interval for exchange of the tappet

To enter a desired final value, you have to use the functions “Set Nozzle” for the nozzle and “Set Tappet” for the tappet. They are located in the submenu “Status”. Results are also displayed in the form of 8 bars, each of them representing 12.5 % of the total value. Once 100 % are reached, the red maintenance LED is lit. The corresponding item (nozzle or tappet) has to be exchanged. After the exchange, you have to reset the corresponding counter to “0”. Use the functions “Reset Nozzle” or “Reset Tappet” in submenu “Status” (see paragraph 4.5.4, page 34).

10.2 Maintenance of Tappet, Tappet Sealing and Nozzle Insert

As the tappet, the tappet sealing and the nozzle insert belong to the wearing parts of the system, they need to be cleaned and exchanged regularly.

10.2.1 Maintenance of the Tappet

The tappet has to be cleaned and exchanged in regular intervals (at least every 40 million shots) or in the case of problems (as soon as it starts to move in a sluggish way). Please be aware that the lifespan of the tappet not only varies by the material and size, but also depends on your application. Ceramics (CTF, SNTF), tungsten carbide (TTF) and diamond (PDTF) items are available. The tappet consists of the tappet rod and the tappet spring.

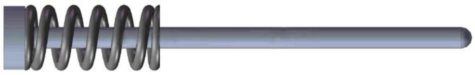


Fig. 76: Example - TTF Tappet (consists of tappet rod and tappet spring)

10.2.2 Maintenance of the Tappet Sealing

For replacement of tappet sealings a particular counter is not provided, as the necessity depends on current applications, substances to be dispensed etc. Caused by the tappet movement, some materials tend to penetrate between tappet and tappet sealing, giving rise to abrasion. Therefore, you have to inspect the tappet sealing from time to time. To continue working with a damaged tappet sealing inevitably entails unexpected interruptions, loss of material and an increased need of cleaning. In some cases, even the actuator can be damaged, due to the ingress of liquid.

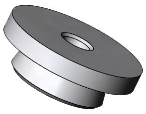


Fig. 77: Example - Tappet Sealing PE

10.2.3 Maintenance of the Nozzle Insert

The nozzle insert has to be cleaned and exchanged in regular intervals or in the case of problems. Please be aware that the lifespan of the nozzle insert depends on your application. After disassembling the nozzle insert, immediately use a cleaning wire to push through the channel of the nozzle insert, to avoid hardening of residue medium. Do not use a clogged nozzle insert, since it would strongly compromise your dispensing results. Exchange the nozzle insert as soon as it is worn out, since otherwise it can cause a leakage problem.

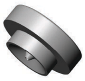


Fig. 78: Example - Nozzle Insert N11

10.2.4 Exchange of the Tappet, the Tappet Sealing and the Nozzle Insert

For the necessary steps of de-/mounting the tappet/tappet sealing/nozzle insert, please see the chapter about cleaning (see chapter 9, page 136). Before disassembling the system, perform the cleaning procedure explained in the same chapter. There you will also find the necessary information of how to clean the tappet/tappet sealing/nozzle insert.

INFORMATION

Perform the adjust after exchanging parts

Before you start the dispensing process, do not forget to perform the adjust after each exchange or remounting of the nozzle fixation nut. For details of the adjust process, see paragraph 6.5, page 60.

11 Error Messages

The following pages list all the error messages you could encounter when using this system. The table in paragraph 11.1, page 157 will give you a quick overview. In paragraph 11.2, page 158 every error message is explained in detail.

In case of an error, an error message is shown in the display and the red attention LED is switched “ON“. This information can also be obtained via pin 13 of the PLC interface (see paragraph 8.2 "PLC-Interface: 15-pin, Sub-D", page 127). Press **[enter]** to clear the display. If this does not work, switch “OFF” the control unit. Check the system for potential problems (e.g. loose cables) and re-start the system.

If the error still occurs, please contact the Technical Support at VERMES Microdispensing or your local supplier (see Page 7).

INFORMATION

Storing error messages

After the re-start, the error message can only be found in the submenu “Error” paragraph 4.5.4, page 34.

INFORMATION

Valve status depending on error

If the valve is open or closed after an error message, depends on the respective error. In paragraph 11.2, page 158 it is mentioned for each error.

11.1 Table of Error Messages

The following table lists all error messages with their error code and when they might appear.

Error Code	Error Message	Related to	When?
101	101 wrong valve	Valve	Start-up
102	102 wrong piezo type	Valve	Start-up
104	104 sensor communication error	Valve	Operation
190	190 incorrect valve data	Valve	Start-up, Operation
191	191 nozzle/tappet error > enter	Valve	Start-up, Operation
199	199 valve error escape for auxi.	Valve	Start-up
301	301 no valve present error	Valve	Start-up
302	302 actuator connection error	Valve	Operation
303	303 adjust error press enter	MDC	HW adjust
501 / -	501 valve defect error *or* maintenance needed	Valve	Start-up, Operation
502	502 MDV temp.high please wait	Valve	Start-up, Operation
601	601 USART buffer overflow	RS-232C	Operation
701	701 valve driver defect	MDC	Start-up, Operation
702	702 WD timeout press enter	MDC	Start-up, Operation
703	703 RS powsupply press enter	MDC	Start-up, Operation
810	810 communication error	MDC	Start-up, Operation
820	820 incorrect heater data	Heater	Start-up, Operation
830	830 wrong heater	Heater	Operation
835	835 heating temp out of range	Heater	Operation
838	838 heater time out	Heater	Operation
840	840 heater unplugged	Heater	Operation
850	850 MDC not calibrated!	MDC	Start-up
855	855 incorrect bus data	MDC	Operation
860	860 incorrect cooler data	MDC	Operation
870	870 wrong cooler	Cooling	Start-up, Operation
875	875 cooler wrong PT100-signal	MDC	Start-up, Operation
880	880 cooler unplugged	Cooling	Operation
890	890 cooler not calibrated	Cooling	Start-up, Operation
901	901 RAM-data error press enter	MDC Data	Start-up, Operation
902	902 EEPROM not formatted > enter	MDC Data	Start-up, Operation
903	903 EEPROM write error > enter	MDC Data	Operation
904	904 setup save error > enter	MDC Data	Operation
905	905 setup load error > enter	MDC Data	Operation
999	999 error in errorlist	MDC Data	Operation

11.2 Explanations of Error Messages

101	**101 Incorr. Valve**	
	This message sometimes appears during startup of the system. The control unit checks the data of valve and control unit. If the control unit does not recognize the valve resp. the required valve type (e.g. finds a low viscosity valve), the error message is displayed.	
	Error code display:	101 Incorr. Valve
	Error code status menu:	101 Incorr. Valve
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Maybe an inadequate valve type has been installed. • Check MDC (if possible, test system with another MDC • Send MDC and/or valve to VERMES Microdispensing or to your supplier
	Valve:	Valve still open (start-up of the MDC)

102	**102 Incorrect Piezo Type**	
	The piezoelectric element does not match the current application (Valve Passport). This error message appears with the start-up of the control unit.	
	Error code display:	102 Incorrect Piezo Type
	Error code status menu:	102 Incorrect Piezo Type
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Exchange valve
	Valve:	Valve still open (start-up of the MDC)

104	**104 Sensor Communication Error**	
	This error message appears, when there is a problem with the sensor cable. If cooling is activated, it will be deactivated by error 104. If a heater is activated, it will **not** be deactivated by error 104. **Important Note!** This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early. When using an MFC for cooling, you always have to keep this order of steps: 1. Switch ON MFC 2. Switch ON the channel used for cooling at the MFC 3. Switch ON MDC	
	Error code display:	104 Sensor Communication Error
	Error code status menu:	104 Sensor Communication Error
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF control unit, and inspect the connection. If the cable is damaged, it must be exchanged before restarting. • Exchange valve
	Valve:	Valve is closed

190	**190 Incorrect Valve Data**	
	This error message appears, if a checksum error occurs while writing the Cycle Counter. **Important Note!** The most common cause for this error is to unplug the valve before switching OFF the MDC or before the MDC has completely shut down.	
	Error code display:	190 Incorrect Valve Data (Press Enter)
	Error code status menu:	No entry
	Error handling:	• Press **[enter]**-key to acknowledge error message. • If error happens repeatedly, switch OFF control unit, and inspect the connection. If necessary, exchange the cable and/or valve.
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open; otherwise, it is closed.

191	**191 NozzleTappet Load Err.**	
	During startup of the control unit, the system reads the counters (e.g. nozzle counter, tappet counter). If a problem arises, this error message is displayed. The problem might also appear during operation, while user is changing the values. Corresponding values may be doubtful, until a new cycle is started.	
	Error code display:	191 NozzleTappet Load Err Enter.
	Error code status menu:	No entry
	Error handling:	• Press **[enter]**-key to acknowledge error message. • Re-start the MDC. • In case the error acknowledgement does not work, the valve might be defect. If possible, test valve with different MDC and MDC with different valve. If the valve is defect, send it in for repair.
	Valve:	Valve is open

199	**199 Valve Error**	
	General valve data error (Sensor connection). When the checksum of the valve EEPROM is compared to software data during startup, mismatch is notified by this message. This error message appears with the start-up of the MDC. At this point, you have the opportunity to switch to Auxiliary Mode. **Important Note!** This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early. When using an MFC for cooling, you always have to keep this order of steps: 1. Switch ON MFC 2. Switch ON the channel used for cooling at the MFC 3. Switch ON MDC	
	Error code display:	199 Valve Error Escape for Auxi.
	Error code status menu:	199 Valve Error
	Error handling:	• The sensor connection has not been plugged in correctly. Switch OFF MDC and inspect the sensor cable and its connection. • Send valve to VERMES Microdispensing or to your supplier
	Valve:	Valve still open (start-up of the MDC)

301	**301 No Valve Present Error**	
	The control unit does not recognize the valve during startup.	
	Error code display:	301 No Valve Present Error
	Error code status menu:	301 No Valve Present Error
	Error handling:	• The actuator connection has not been plugged in correctly. Switch OFF MDC and inspect the actuator cable and its connection. If the actuator cable is damaged, it must be exchanged before restarting. • Check MDC • Send valve and/or MDC to VERMES Microdispensing or to your supplier
	Valve:	Valve still open (start-up of the MDC)

302	**302 Actuator Connection Error**	
	With system in operation, the connection between valve (actuator) and MDC is disrupted. If a heater is activated, it will be deactivated by error 302. If cooling is activated, it will **not** be deactivated by error 302.	
	Error code display:	302 Actuator Connection Error
	Error code status menu:	302 Actuator Connection Error
	Error handling:	• The actuator connection has not been plugged in correctly. Switch OFF MDC and inspect the actuator cable and its connection. If the actuator cable is damaged, it must be exchanged before restarting. • Check MDC • Send valve to VERMES Microdispensing or to your supplier
	Valve:	Valve is open

303	**303 adjust error**	
	This error can happen during operation. During the adjust a problem affects the calibration.	
	Error code display:	303 adjust error press enter
	Error code status menu:	303 adjust error
	Error handling:	• Switch OFF MDC, switch it back ON and try again. • If possible, check MDC with a different valve, to see, if the adjust works there • If possible, check valve with a different MDC, to see, if the adjust works there • Send valve and/or MDC to VERMES Microdispensing or to your supplier
	Valve:	Valve is closed

<table>
<tr><td rowspan="6">501</td><td colspan="2"><b>501 Valve Defect Error</b></td></tr>
<tr><td colspan="2">The valve fails during operation, e.g. due to a damaged piezoelectric element.

<b>Important note!</b>
If there is a valve error, while a maintenance is needed (according to warranty and maintenance document), the message “Maintenance needed” is shown in the display.</td></tr>
<tr><td>Error code display:</td><td>501 Valve Defect Error
<i>or</i>
Maintenance needed</td></tr>
<tr><td>Error code status menu:</td><td>501 Valve Defect Error</td></tr>
<tr><td>Error handling:</td><td>• Switch off the MDC, remove the valve and send it to VERMES Microdispensing or to your supplier (regular maintenance is advisable)</td></tr>
<tr><td>Valve:</td><td>Valve is open</td></tr>
</table>

502

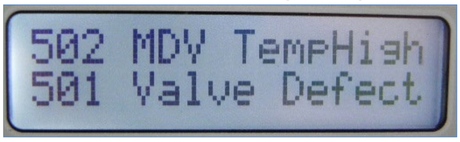
502 MDV TempHigh

Automatic shut-down because of high temperature
In order to protect the piezoelectric element from excessive heat, the temperature is internally monitored by a corresponding circuit. This is automatically switching OFF the system in case of need. As the needle lift has a big impact on the condition of the piezo, the temperature limit is depended on the needle lift as well.
Limits::
NL ≤ 80 % = 140 °C
NL > 80 % = 120 °C (from 81 % – 100 % the temperature is variable at ca. 140 °C – 120 °C)

Once the temperature has fallen below 80 °C, the display changes from “502 MDV TempHigh Please Wait” to “502 MDV TempHigh Press Enter”. After pressing the **[enter]** key, you can again trigger normally. During the display of “502 MDV TempHigh” the valve is closed.
If the error message happens directly after starting the MDC, pressing **[enter]** will initiate a restart.

If a heater is activated, it will be deactivated by error 502. If cooling is activated, it will **not** be deactivated by error 502.

In certain circumstances, it can happen that in this phase an error “501 Valve Defect Error” is detected. In this case, both errors are shown in the display of the MDC (see picture below). Follow the instructions regarding error 501.



```
502 MDV TempHigh
501 Valve Defect
```

Important Note!

This error message can also appear, when the MDC is connected to an MFC 3000 for cooling a valve, and you switched ON the MDC too early.
When using an MFC for cooling, you always have to keep this order of steps:

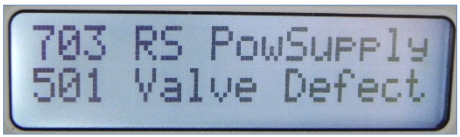
1. Switch ON MFC
2. Switch ON the channel used for cooling at the MFC
3. Switch ON MDC

Error code display:	502 MDV TempHigh Please Wait
Error code status menu:	502 MDV TempHigh
Error handling:	• The temperature of the valve is too high. System has to cool off, then press [enter]. Maybe you have to lower the Needle Lift and/or frequency parameters, in order to prevent a re-occurrence of the problem. In case of an air cooled valve, you need to increase the air flow. • Switch OFF control unit, and inspect the sensor and actuator cables and their connections. If a cable is damaged, it must be exchanged before restarting. • If your dispensing application includes the use of an MFC and a flow control valve FCV, make sure the channel for cooling in the MFC is switched “ON”, before you start the MDC (see also User Manual MFC 3000, chapter 5.9.3)
Valve:	Valve is closed

601	**601 USART Buffer Overflow**	
	This problem sometimes occurs during data transmission via serial interface. The buffer is full and the MDC is unable to handle more inflowing data. The message "601 USART Buffer Overflow" is returned via serial interface. LEDs are not lit.	
	Error code display:	No error message
	Error code status menu:	601 USART Buffer Overflow
	Error message monitor:	601 USART Buffer Overflow
	Error handling:	• Interrupt data transmission • Send data again
	Valve:	Valve remains unchanged.

701	**701 Valve Driver Defect**	
	A hardware failure of the valve control is probable (e.g. short circuit in the connection of the piezoelectric element). This problem is possible during startup of the MDC and also with system in operation.	
	Error code display:	701 Valve Driver Defect
	Error code status menu:	701 Valve Driver Defect
	Error handling:	• Switch OFF the MDC immediately. Inspect the actuator cable connection. Worn, kinked or charred cables must be exchanged. • The MDC must be returned to the manufacturer. The valve has to be checked (if that is not possible, it has to be send as well).
	Valve:	Valve is open

702	**702 Watchdog TimeOut**	
	Abnormal end (crash) of the MDC. **Information!** If a cooler or a heater was turned on before, it will be turned on again after the boot-up of the system.	
	Error code display:	702 Watchdog TimeOut pr. Enter
	Error code status menu:	702 Watchdog TimeOut
	Error handling:	• Press **[enter]**-key to acknowledge error message. The MDC restarts automatically.
	Valve:	Valve still open (start-up of the MDC)

703	**703 RS Power Supply**	
	This error message appears, if a problem with the power supply forces a re-start of the system. If this happens more than once, you need to change your dispensing parameters, since your current settings use too much power over time. In certain circumstances, it can happen that in this phase an error "501 Valve Defect Error" is detected. In this case, both errors are shown in the display of the MDC (see picture below). Follow the instructions regarding error 501.  703 RS PowSupply 501 Valve Defect	
	Error code display:	703 RS Power Supply pr. Enter
	Error code status menu:	703 RS Power Supply
	Error handling:	• Press **[enter]-**key to acknowledge error message. • Lower the dispensing frequency, since your current settings need too much power.
	Valve:	Valve still open (start-up of the MDC)

810	**810 communication error**	
	There is an error with the internal communication.	
	Error code display:	810 communication error
	Error code status menu:	810 communication error
	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater and cooler status will be switched "OFF" in the submenu "Heater/Cooler". • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

820	**820 incorrect heater data**	
	The heater has incorrect data.	
	Error code display:	820 incorrect heater data
	Error code status menu:	820 incorrect heater data
	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched "OFF" in the submenu "Heater". • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

830	**830 wrong heater**	
	The MDC cannot read the data from the heater correctly. Either the heater is defect or the heater cable.	
	Error code display:	830 wrong heater
	Error code status menu:	830 wrong heater

	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched “OFF” in the submenu “Heater”. • Change the heater cable and try again. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

835	**835 heating temp out of range**	
	This error appears, if the temperatures suddenly moves very high or low, while the heater is in its steady state phase.	
	Error code display:	835 heating temp out of range
	Error code status menu:	835 heating temp out of range
	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched “OFF” in the submenu “Heater”. • Check all settings and connections (if necessary, exchange defect cable) and try again. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

838	**838 heater time out**	
	This error appears, if the heater is active, but is not able to reach the target temperature in the usual time. This error can have two different causes. • The heater does not reach the target temperature, because of some set-up problem (e.g. a cable is not connected correctly). • The valve itself creates too much heat, especially in a high-frequency or heavy-load application. Therefore, the current temperature is above the target temperature. You need to reduce the cooler set temperature.	
	Error code display:	838 heater time out
	Error code status menu:	838 heater time out
	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched “OFF” in the submenu “Heater”. • Check all settings and connections (if necessary, exchange defect cable) and try again. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

840	**840 heater unplugged**	
	Is the heater not connected, although the heater is activated in the submenu “Heater”, the error message “840 heater unplugged” appears. The display then switches between this message and the message “Press enter”.	
	Error code display:	840 heater unplugged
	Error code status menu:	840 heater unplugged

	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched “OFF” in the submenu “Heater”. • Connect the heater.
	Valve:	Valve is closed

850	**850 MDC not calibrated!**	
	The error message “850 not calibrated! pr. Enter” appears, if the calibration values of the heater are incorrect at the start-up of the MDC. The values will be overwritten with the factory settings. There will be no entry in the error list.	
	Error code display:	850 MDC not calibrated!
	Error code status menu:	No entry
	Error handling:	• Press **[enter]** key to acknowledge the error message. If no heater or cooling are needed, you can keep working without calibration. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

855	**855 incorrect bus data**	
	There is a problem with the internal communication. The transfer of data between MDC and heater or cooling is interrupted.	
	Error code display:	855 incorrect bus data
	Error code status menu:	855 incorrect bus data
	Error handling:	• Press **[enter]** key to acknowledge the error message. Heater status will be switched “OFF” in the submenu “Heater“. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

860	**860 incorrect cooler data**	
	There is an error with the internal communication. The communication between MDC and cooling is interrupted.	
	Error code display:	860 incorrect cooler data
	Error code status menu:	860 incorrect cooler data
	Error handling:	• Press **[enter]** key to acknowledge the error message. Cooling status will be switched “OFF” in the submenu “Cooler“. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

870	**870 wrong cooler**	
	The MDC cannot read the data from the cooling valve correctly. Either the cooling valve is defect or the connection cable.	
	Error code display:	870 wrong cooler
	Error code status menu:	870 wrong cooler

	Error handling:	• Press **[enter]** key to acknowledge the error message. Cooling status will be switched "OFF" in the submenu "Cooler". • Change the connection cable and try again. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

875	**875 wrong cooler PT100-signal**	
	The MDC receives an incorrect PT100 signal.	
	Error code display:	875 wrong cooler PT100-signal
	Error code status menu:	875 wrong cooler PT100-signal
	Error handling:	• Press **[enter]** key to acknowledge the error message. Cooling status will be switched "OFF" in the submenu "Cooler". • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

880	**880 cooler unplugged**	
	Is the cooling valve not connected, although the cooling valve is activated in the submenu "Cooler", the error message "880 cooler unplugged" appears.	
	Error code display:	880 cooler unplugged
	Error code status menu:	880 cooler unplugged
	Error handling:	• Press **[enter]** key to acknowledge the error message. Cooling status will be switched "OFF" in the submenu "Cooler". • Connect the cooling valve.
	Valve:	Valve is closed

890	**890 cooler not calibrated**	
	This error appears in case the connected cooling valve is not calibrated.	
	Error code display:	890 cooler not calibrated
	Error code status menu:	890 cooler not calibrated
	Error handling:	• Press **[enter]** key to acknowledge the error message. Cooling status will be switched "OFF" in the submenu "Cooler". • Calibrate the cooling valve. • For further information, contact the Technical Support (see Page 7).
	Valve:	Valve is closed

901	**901 RAM Data Error**	
	During the check of RAM data, a problem arises. The message has to be acknowledged by the **[enter]**-key. The system reformats the EEPROM, replacing current values with the factory settings.	
	Error code display:	901 RAM Data Error pr. Enter
	Error code status menu:	901 RAM Data Error

	Error handling:	• Press **[enter]**-key to acknowledge error message. • Reenter the working configuration.
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

902	**902 EEPROM not formatted**	
	A corrupted memory area becomes obvious when reading the EEPROM.	
	Error code display:	902 EEPROM not formatted Enter
	Error code status menu:	902 EEPROM not Formatted
	Error handling:	• Press **[enter]**-key to acknowledge error message – the factory settings will be loaded • You have to reenter your dispensing parameters • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

903	**903 EEPROM Write Error**	
	The problem can occur when writing data to the EEPROM.	
	Error code display:	903 EEPROM Write Error pr. Enter
	Error code status menu:	903 EEPROM Write Error
	Error handling:	• Press [enter] key to acknowledge error message. • If the problem arises when modifying program parameters, the new values are not saved in the EEPROM. After restart of the MDC, the former values of the EEPROM will be loaded. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

904	**904 Setup Save Error**	
	The storing procedure for a setup, initiated by **[save]** key, fails.	
	Error code display:	904 Setup Save Error pr. Enter
	Error code status menu:	904 Setup Save Error
	Error handling:	• Press **[enter]** key to acknowledge error message. After restart of the MDC, the factory settings will not be loaded. • You have to reenter your dispensing parameters. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier.
	Valve:	Valve is closed

905	**905 Setup Load Error**	
	This problem may arise during the retrieval of a setup by **[recall]** key.	

	Error code display:	905 Setup Load Error pr. Enter
	Error code status menu:	905 Setup Load Error
	Error handling:	• Press **[enter]** key to acknowledge error message • Repeat the procedure. If the problem persists, you have to enter new data to the corresponding memory position. • In case the error appears again, send the MDC to VERMES Microdispensing or to your supplier
	Valve:	Valve remains unchanged. If the error message appears during the start of the MDC, the valve is open, otherwise it is closed.

999	**999 Error in Errorlist**	
	The problem cannot be assigned to any other error code from the list. This error only appears while browsing through the error list in the status menu.	
	Error code display:	999 Error in Errorlist
	Error code status menu:	999 Error in Errorlist
	Error handling:	• Move on in the error list or leave the submenu “Error”.
	Valve:	Valve is closed

11.3 Status Messages

The following table lists all the status messages you could encounter when using this system (see Tab. 34). Status messages can appear while you plug IN or OUT a heater or a cooling valve, as well as in connection with the calibration of a heater (see paragraph 7.13.2, page 83).

INFORMATION

Status messages are not stored

Status messages disappear after approx. 2 s from the display. They are not saved. A special case is a calibration gone wrong. Then you get three times in a row the alternating messages “Wrong calibration” and “Please try again!”, separated by approx. 1.5 s.

Status message	Concerns	Notes
Cooler connected	Cooling	Cooling valve connected successfully
Cooler could not be activated	Cooling	Cooling valve could not be activated (e.g. because the flow control valve is not connected correctly or because the wrong device is connected)
Cooler is disconnected	Cooling	Cooling valve was disconnected during operation
Heater connected	Heater	Heater connected successfully
Heater could not be activated	Heater	Heater could not be activated (e.g. because the heater is not connected correctly or because the wrong device is connected)
Heater is disconnected	Heater	Heater was disconnected during operation
Please try again!	Calibration	Calibration was not finished successfully (e.g. because calibrator was connected twice). Please try again.
Wrong calibration	Calibration	Calibration of the heater (or of heater **and** cooling) not correct

Tab. 34: List of status messages

12 Transport, Storage and Disposal

12.1 Transport

For shipment, the system is packed in an appropriate case. Preserve it for further transport procedures in the future. The necessity can never be excluded, e.g. for purposes of maintenance. Observe the following measures.

- If the original packaging is no longer available, select a suitable material for the package.
- Pack in a way that protects the delivery against shock and vibrations.
- Fill empty spaces with appropriate material (e.g. paper, insulating air cushion, Styrofoam).
- Decontaminate the system completely before shipping it.
- Fill out the corresponding form completely (see paragraph 14.8, page 190). Attach it, clearly visible, at the exterior of the package.

⚠ CAUTION

Decontamination

The customer is liable for all consequences resulting from insufficient decontamination of the system (health of transport personnel)!

12.2 Storage

The environmental conditions in the room intended for storage should fulfill the requirements of the system.

Observe the following storage conditions.

- The room should be sufficiently ventilated and free of dust
- Admissible temperature: Between +5 °C and +30 °C
- Rel. humidity < 50 %
- The system should not be stored together with fuel, solvents, lubricants, acids and other chemicals able to develop vapors, which may aggress to the surface of the components.

Air-tight foil sheathing with included desiccants may be useful.

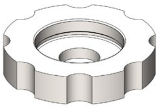
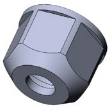
12.3 Recycling and Disposal

	The entire packaging consists of 100 % recyclable material.
	At the end of its lifetime, the product itself should be discarded in conformity with local regulations. Prescriptions with respect to handling of electrical scrap have to be observed.

13 Spare Parts and Tools

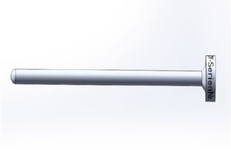
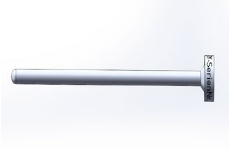
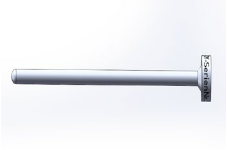
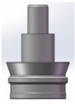
Here are some of the most important spare and extra parts as well as tools. For the latest and complete list, please check our homepage at www.vermes.com.

13.1 Nozzle Fixation Nuts

		
Nozzle Fixation Nut NFN-TA-HC Order no. 1014181	**Double Channel Nozzle Fixation Nut NFN-TA** Order no. 1016198	**Nozzle Fixation (IB variants)** NFN-TA-HC-IB Order no. 1014493 NFN-TA-IB Order no. 1014494 (for use with isolation body)

Tab. 35: Nozzle Fixation Nuts

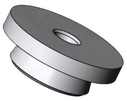
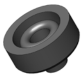
13.2 Tappets

		
Tappet rod CTF CTF 4 Order no. 1013126 CTF 7 Order no. 1013125 CTF10 Order no. 1013124 CTF15 Order no. 1012884	**Tappet rod TTF** TTF 4 Order no. 1012892 TTF 7 Order no. 1012891 TTF10 Order no. 1012890 TTF15 Order no. 1012889 TTF20 Order no. 1013185 TTF23.5 Order no. 1015125 TTF30 Order no. 1016497	**Tappet rod SNTF** SNTF 4 Order no. 1014240 SNTF 7 Order no. 1014243 SNTF10 Order no. 1014244 SNTF15 Order no. 1014245 SNTF23.5 Order no. 1015752
Tappet rod 2G CTF 2G CTF 4 Order no. 1015241 2G CTF 7 Order no. 1015242 2G CTF10 Order no. 1015243 2G CTF15 Order no. 1015244	**Tappet rod 2G TTF** 2G TTF 4 Order no. 1015235 2G TTF 7 Order no. 1015236 2G TTF10 Order no. 1015218 2G TTF15 Order no. 1015217	**Tappet rod 2G SNTF** 2G SNTF 4 Order no. 1015253 2G SNTF 7 Order no. 1015254 2G SNTF10 Order no. 1015255 2G SNTF15 Order no. 1015256
Tappet rod 2G CTF + 10 mm 2G CTF 4 +10 mm Order no. 1015644 2G CTF 7 +10 mm Order no. 1015645 2G CTF 10 +10 mm Order no. 1015646 2G CTF 15 +10 mm Order no. 1015647 (only compatible with 1015316)	**Tappet rod 2G TTF + 10 mm** 2G TTF 4 +10 mm Order no. 1015639 2G TTF 7 +10 mm Order no. 1015640 2G TTF 10 +10 mm Order no. 1015641 2G TTF 15 +10 mm Order no. 1015642 (only compatible with 1015316)	**Tappet rod 2G SNTF + 10 mm** 2G SNTF 4 +10 mm Order no. 1015648 2G SNTF 7 +10 mm Order no. 1015649 2G SNTF 10 +10 mm Order no. 1015650 2G SNTF 15 +10 mm Order no. 1015651 (only compatible with 1015316)
		
Tappet spring TF-PR Order no. 1014620 SN Order no. 1017165	**Tappet centering screw BY** BY (stainless steel) Order no. 1014228 HM-BY (carbide) Order no. 1014679 23.5 BY Order no. 1014709 2G BY Order no. 1015221	**Tappet Grease TF** 1 ml Order no. 1014637 10 ml Order no. 1014636 310 ml Order no. 1014635

Tappet centering screw 2G BY +10 mm Order no. 1015316		

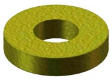
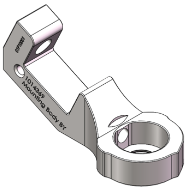
Tab. 36: Tappets

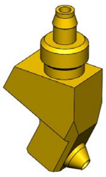
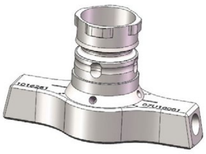
13.3 Sealings

		
Tappet sealing PE Order no. 1007067 PTFE Order no. 1010247	**Tappet sealing LX CeTeDur 170** Order no. 1013327 (no tappet centering piece needed) Other variants on request	**Tappet sealing HT** Order no. 1015823
O-Ring-BY NBR Order no. 1014226 (black) EPDM Order no. 1017525 (black) Viton Order no. 1014385 (green) *Large:* EPDM Order no. 1017526 (black)	**O-Ring-Safe – EPDM** 3 ccm Order no. 1017353 5 ccm Order no. 1017354 10 ccm Order no. 1017355 30/55ccm Order no. 1017356 *(black)*	**O-Ring-Safe – NBR** 3 ccm Order no. 1015892 5 ccm Order no. 1015895 10 ccm Order no. 1015897 30/55ccm Order no. 1015899 *(10 pieces, black)*

Tab. 37: Sealings

13.4 Supply Unit

Cartridge 3 ccm Order no. 1007091 5 ccm Order no. 1012914 10 ccm Order no. 1008361 30 ccm Order no. 1007087 (also available nontransparent for light or UV light)	**Cartridge Holder TA-MDFH-BA** Order no. 1014722 (with inlets for 3/5/10/30 cc cartridges)	**Cartridge Holder TA** 30 ccm Order no. 1014057 10 ccm Order no. 1014056 5 ccm Order no. 1014055 3 ccm Order no. 1014054
		
Connector BY Order no. 1014234	**Tappet Centering Piece PEEK** Order no. 1009419	**Fluid Box Body MDF 3078-BY** Order no. 1014224
		
Fluid Box Body MDF 3078-BY +10mm Order no. 1016061	**MDFH Isolation Body BY** Order no. 1014232	**Mounting Body BY** Order no. 1014369

Cartridge Base CHI-HT Order no. 1014517	**Cartridge Base CHI** Order no. 1014060	**Cartridge Base CH** Order no. 1015638
		
Fluid Box Connector CH-HO PEEK Order no. 1014352 Brass Order no. 1015084 Wirbalit Order no. 1015097	**Adapter Safe for compressed air** 3 ccm Order no. 1014953 5 ccm Order no. 1014952 10 ccm Order no. 1014951 30/55 ccm Order no. 1014950	**Cartridge CC/30 heat resistant** 30 ccm Order no. 1007087 **(white, heat resistant until 180 °C)**
		
Double Channel Fluid Box Body MDF 3078-BY Order no. 1016261	**Fluid Box Connector CH-HT-NPT** PEEK Order no. 1015145	**Tightening Screw** PEEK Order no. 1013487 Stainless Steel Order no. 1010027

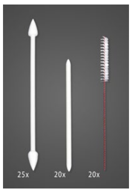
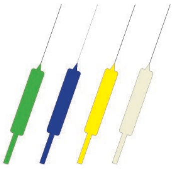
Tab. 38: Supply unit

13.5 Heaters and Heater Controllers

MHC 48-2 Order no. 1015680	**MFC 3000** Order no. 1014981	**Heater MDH-48-BY** MDH-48-BY-BH Order no. 1015224 MDH-48-BY Order no. 1014231

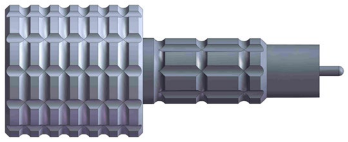
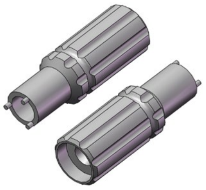
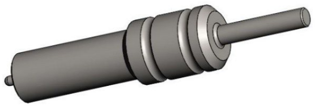
Tab. 39: Heaters and Heater Controllers

13.6 Cleaning Tools

		
CTK – Cleaning Tool Kit 2.5 Order no. 1014632 consists of: 25 pcs. Fluid Box Cleaners (P: 1013266) 20 pcs. Cleaning Rods 2.5 (P: 1014631) 20 pcs. Fluidic Brushes 2.5 (P: 1014422) (P = Order no. for only these parts)	**Nozzle Insert Cleaning Wires** size 100 (blue) Order no. 1011208 size 120 (white) Order no. 1011488 size 150 (green) Order no. 1010380 size 200 (orange) Order no. 1010379 size 300 (yellow) Order no. 1012208 size 400 (red) Order no. 1012209 size 500 (gray) Order no. 1015396	**Set – NI Cleaning Reamers** Order no. 1014627 (6 pcs.)
MDT 316 - Nozzle Insert Cleaning Tool Order no. 1013324	**MDT 324 - Nozzle Insert Cleaning Holder** Order no. 1014310 (PEEK) Order no. 1017320 (stainless steel)	

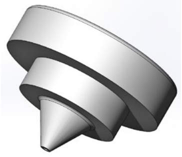
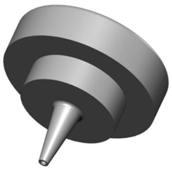
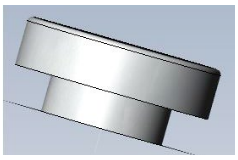
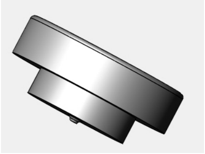
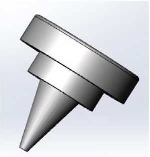
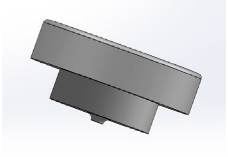
Tab. 40: Cleaning Tools

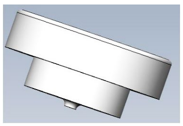
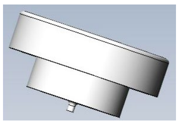
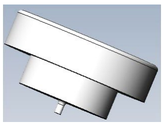
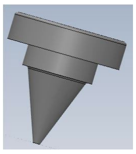
13.7 Tools

		
MDT 301 - Universal Tool Order no. 1010208	**MDT 303 - Nozzle Insert Changing Tool** Order no. 1007083	**MDT 306 - Torque Wrench Tool VM** Order no. 1015062 BitVM Set Order no. 1013398
MDT 307 - Adjust Tool TA Hot Melt Handle Order no. 1014143	**MDT 323 - Nozzle Insert - Squeezing Out Tool TA** Order no. 1014283	**Hexagon Key Set** Order no. 1012993 (can be ordered separately)
MDT 327 Multi-Function Tool		
MDT 327 - Multi-Function Tool Order no. 1014440	**MDT 328 - Tappet Sealing Changing Tool** Order no. 1014503	**MDT 333 - Double Channel Tappet Sealing Changing Tool** Order no. 1016243

Tab. 41: Tools

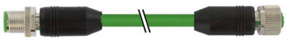
13.8 Nozzle Inserts

Nozzle Insert N11 N11- 70 Order no. 1010343 N11- 90 Order no. 1013129 N11-100 Order no. 1009837 N11-120 Order no. 1010344 N11-150 Order no. 1009838 N11-200 Order no. 1009839 N11-300 Order no. 1013024 N11-400 Order no. 1013025	**Nozzle Insert N13** N13- 30 Order no. 1013444 N13- 40 Order no. 1013443 N13- 50 Order no. 1012846 N13- 60 Order no. 1013393 N13- 70 Order no. 1013344 N13- 75 Order no. 1011781 N13- 80 Order no. 1013345	**Nozzle Insert N14** N14- 70 Order no. 1015070 N14- 250 Order no. 1013055 N14- 300 Order no. 1012097 N14- 400 Order no. 1012098 N14- 600 Order no. 1014532 N14-1200 Order no. 1012901
Nozzle Insert N16 N16-150 Order no. 1012950 N16-200 Order no. 1012951 N16-500 Order no. 1012218 N16-600 Order no. 1012219 N16-700 Order no. 1012220 N16-800 Order no. 1012843 N16-900 Order no. 1012844 N16-1000 Order no. 1012845	**Nozzle Insert N17** N17- 70 Order no. 1013155 N17- 100 Order no. 1013959 N17- 150 Order no. 1013136 N17- 200 Order no. 1012780	**Nozzle Insert N21** N21-100 Order no. 1013045
		
Nozzle Insert N25 N25- 30 Order no.: 1015233 N25- 40 Order no.: 1015234 N25- 50 Order no.: 1015175 N25- 60 Order no.: 1015866 N25- 70 Order no.: 1015174 N25- 80 Order no.: 1015886 N25-100 Order no.: 1013427 N25-120 Order no.: 1014535 N25-150 Order no.: 1013426 N25-180 Order no.: 1014660 N25-250 Order no.: 1014659 N25-500 Order no.: 1013428	**Nozzle Insert N27** N27- 50 Order no.: 1015173 N27-200 Order no.: 1015207	**Nozzle Insert N30** N30-100 Order no.: 1016770
		
Nozzle Insert N34 N34- 30 Order no.: 1017094 N34- 40 Order no.: 1016787 N34- 50 Order no.: 1015452 N34- 70 Order no.: 1015453 N34- 80 Order no.: 1017146 N34- 90 Order no.: 1017147	**Nozzle Insert N43** N43-150 Order no.: 1014457	**Nozzle Insert N64** N64- 50 Order no.: 1016131 N64- 80 Order no.: 1015971 N64- 90 Order no.: 1016132 N64-100 Order no.: 1015025 N64-120 Order no.: 1015026 N64-180 Order no.: 1015027

N34-100 Order no.: 1015231 N34-120 Order no.: 1015454 N34-150 Order no.: 1015455 N34-200 Order no.: 1015230 N34-250 Order no.: 1015456 N34-300 Order no.: 1015228 N34-350 Order no.: 1015696 N34-400 Order no.: 1015229		
		
Nozzle Insert N80 N80-100 Order no.: 1016693	**Nozzle Insert N85** N85- 70 Order no.: 1016976 N85-150 Order no.: 1017444	**Nozzle Insert N90** N90- 70 Order no.: 1017271
Nozzle Insert N92 N92-100 Order no.: 1017315		
Nozzle Insert J01 J01-100 Order no.: 1011463 J01-120 Order no.: 1012997 J01-150 Order no.: 1013016 J01-200 Order no.: 1012863 J01-300 Order no.: 1014838 J01-400 Order no.: 1012883	**Nozzle Insert J02** J02-50 Order no.: 1013032 J02-70 Order no.: 1012878	**Nozzle Insert J03** J03- 200 Order no.: 1012885
		
Nozzle Insert J04 J04-200 Order no.: 1012936 J04-300 Order no.: 1015149 J04-400 Order no.: 1014613 J04-500 Order no.: 1014614 J04-600 Order no.: 1014629	**Nozzle Insert J17** J17-100 Order no.: 1014340	**Nozzle Insert J28** J28- 150 Order no.: 1016936

Tab. 42: Nozzle Inserts

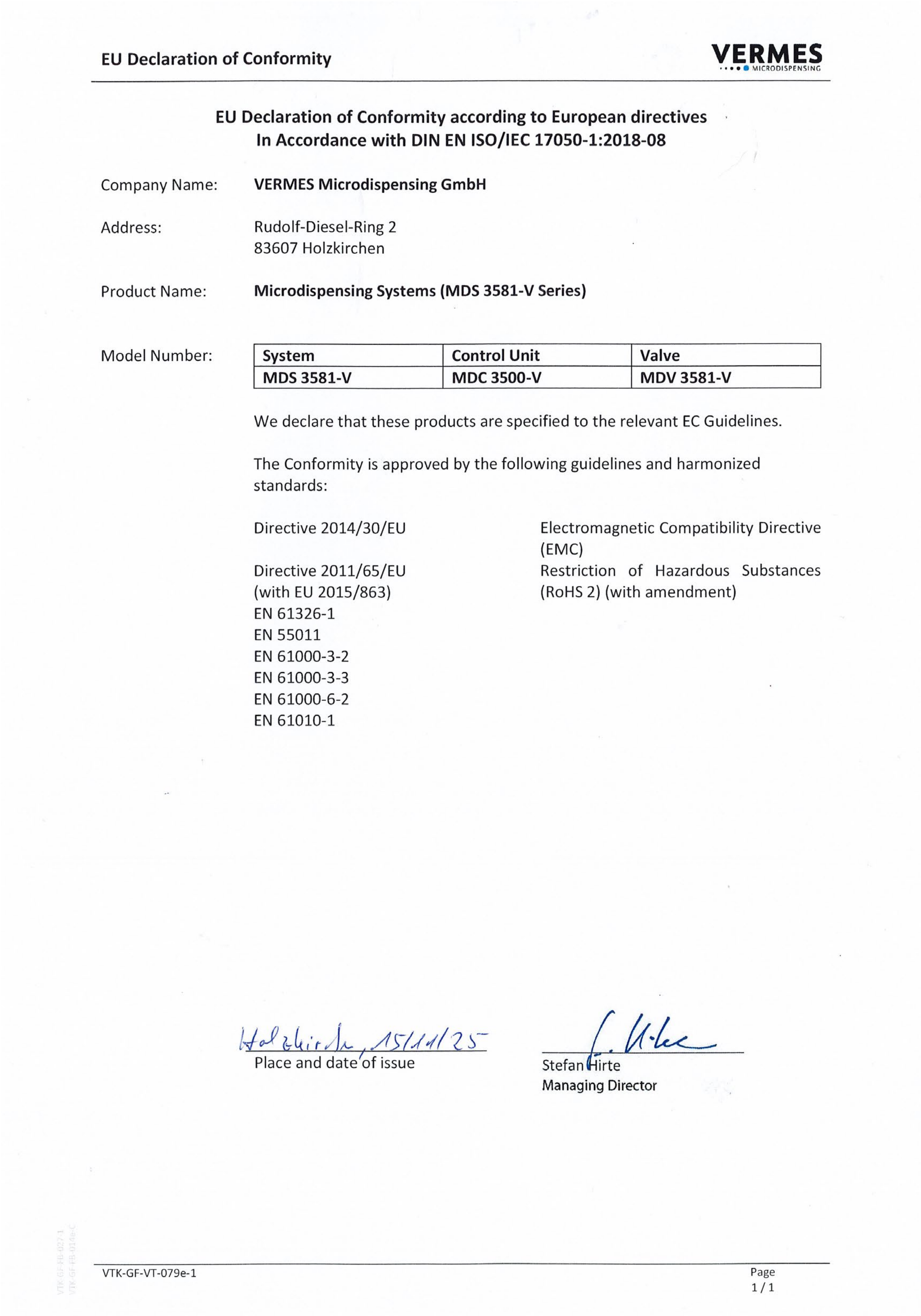
13.9 Other Parts

		
Flow Control Valve FCV FCV-AC 3.5 M12 Order no. 1016480 FCV-AC 6.0 M12 Order no. 1016265 FCV-HF 7.0 M12 Order no. 1016266	**Connection Cable for FCV M12 MDC** 2 m Order no. 1016252 3 m Order no. 1017052 5 m Order no. 1017154 10 m Order no. 1017053 15 m Order no. 1017133	**Heater Cable 48 V** 2 m Order no. 1014064 3 m Order no. 1013970 5 m Order no. 1014033 7 m Order no. 1014008 10 m Order no. 1014188

Tab. 43: Other Parts

14 Attachments

14.1 EU Declaration of Conformity



EU Declaration of Conformity

EU Declaration of Conformity according to European directives
In Accordance with DIN EN ISO/IEC 17050-1:2018-08

Company Name: **VERMES Microdispensing GmbH**

Address:
Rudolf-Diesel-Ring 2
83607 Holzkirchen

Product Name: **Microdispensing Systems (MDS 3581-V Series)**

Model Number:

System	Control Unit	Valve
MDS 3581-V	**MDC 3500-V**	**MDV 3581-V**

We declare that these products are specified to the relevant EC Guidelines.

The Conformity is approved by the following guidelines and harmonized standards:

Directive 2014/30/EU	Electromagnetic Compatibility Directive (EMC)
Directive 2011/65/EU (with EU 2015/863)	Restriction of Hazardous Substances (RoHS 2) (with amendment)
EN 61326-1	
EN 55011	
EN 61000-3-2	
EN 61000-3-3	
EN 61000-6-2	
EN 61010-1	

Holzkirchen, 15/11/25
Place and date of issue

Stefan Hirte
Managing Director

VTK-GF-VT-079e-1

Page
1 / 1

Fig. 79: EU Declaration of Conformity

14.2 Dimensional Drawing MDC 3500-V

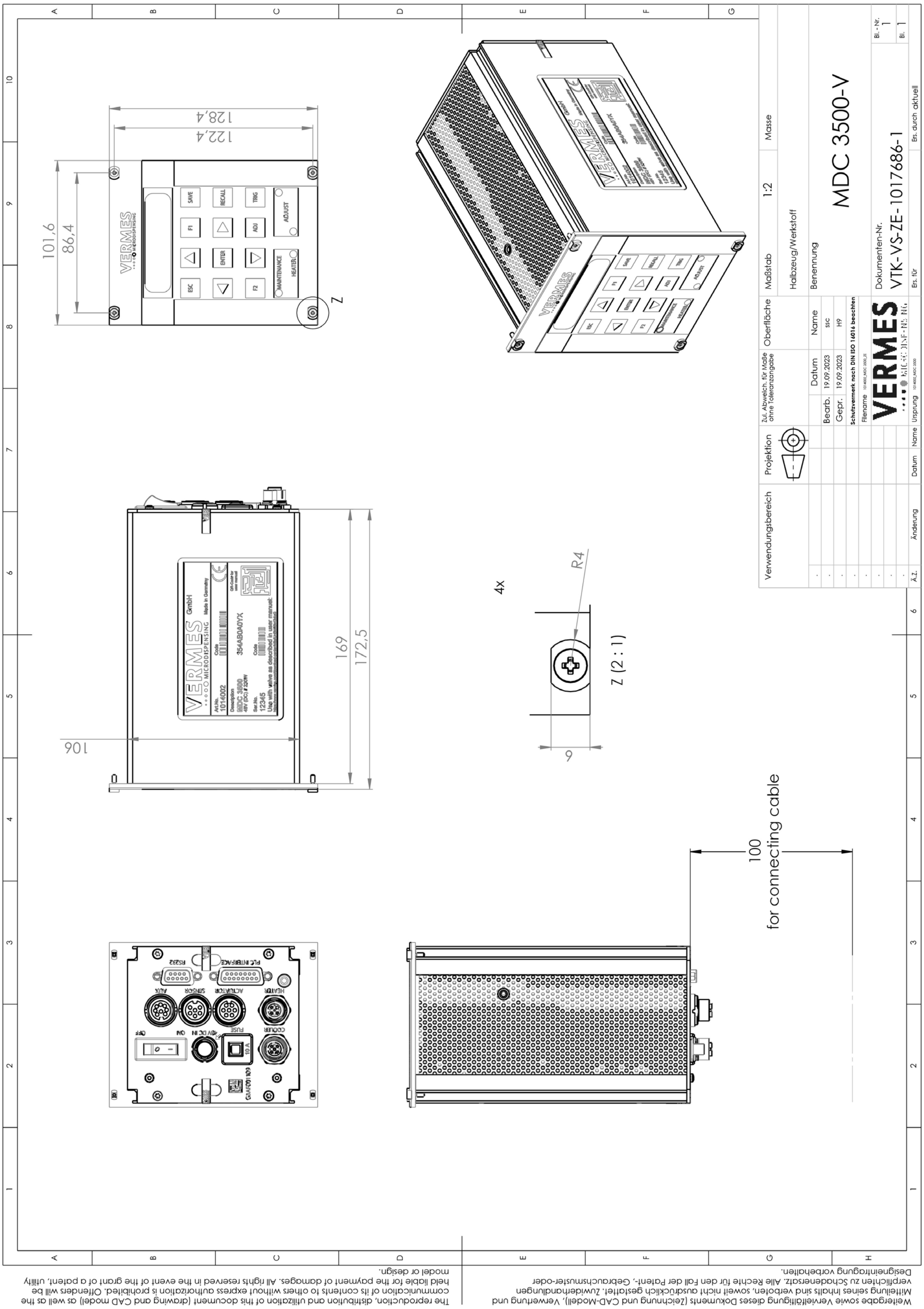

128,4
122,4
101,6
86,4
Z
169
172,5
106
4x
R4
Z (2 : 1)
9
100
for connecting cable
Verwendungsbereich
Projektion
Zul. Abweich. für Maße ohne Toleranzangabe
Oberfläche
Maßstab
1:2
Masse
Halbzeug/Werkstoff
Benennung
MDC 3500-V
Datum
Name
Bearb. 19.09.2023 ssc
Gepr. 19.09.2023 H9
Schutzvermerk nach DIN ISO 16016 beachten
Filename
Dokumenten-Nr.
VTK-VS-ZE-1017686-1
Bl.-Nr. 1
Bl. 1
Ers. durch aktuell
Ers. für
A.Z.
Änderung
Datum
Name
Ursprung
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Fig. 80: Dimensional Drawing MDC 3500-V

14.3 Dimensional Drawing MDV 3581-V

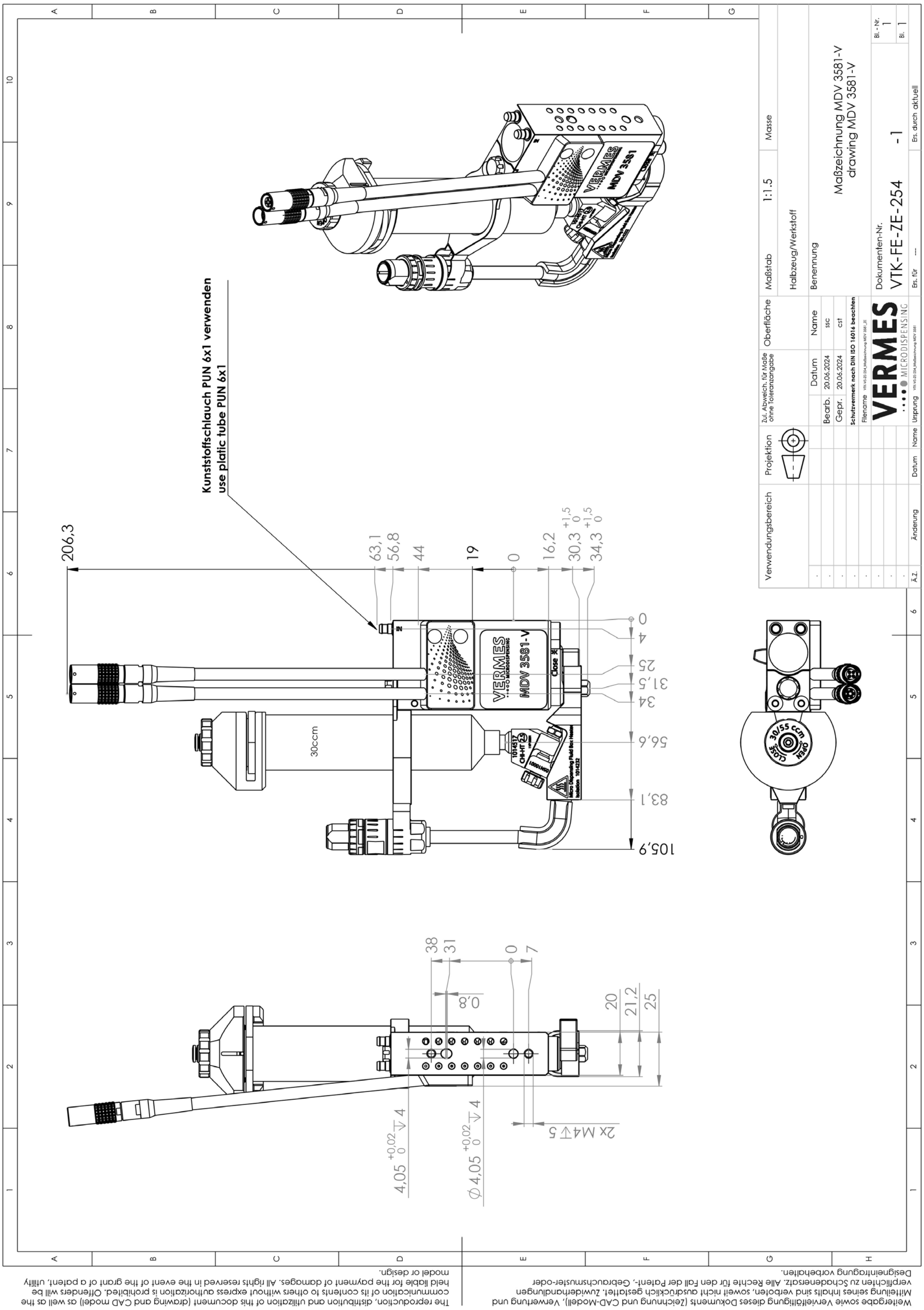
Kunststoffschlauch PUN 6x1 verwenden
use platic tube PUN 6x1
206,3
63,1
56,8
44
19
0
16,2
30,3 +1,5 0
34,3 +1,5 0
0
4
25
31,5
34
56,6
83,1
105,9
30ccm
VERMES MICRODISPENSING
MDV 3581-V
Close
30/55 ccm
OPEN
CLOSE
38
31
0
7
0,8
20
21,2
25
4,05 +0,02 0 ⊽ 4
⌀4,05 +0,02 0 ⊽ 4
2x M4 ⊽ 5
Verwendungsbereich
Projektion
Zul. Abweich. für Maße ohne Toleranzangabe
Oberfläche
Maßstab
1:1.5
Masse
Halbzeug/Werkstoff
Benennung
Maßzeichnung MDV 3581-V
drawing MDV 3581-V
Datum
Name
Bearb.
20.06.2024
ssc
Gepr.
20.06.2024
cst
Schutzvermerk nach DIN ISO 16016 beachten
Filename
VERMES MICRODISPENSING
Dokumenten-Nr.
VTK-FE-ZE-254
-1
Bl. - Nr.
1
Bl.
1
Ers. für
Ers. durch aktuell
Ä.Z.
Änderung
Datum
Name
Ursprung
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Fig. 81: Dimensional Drawing MDV 3581-V

14.4 Connection Diagram PLC-interface

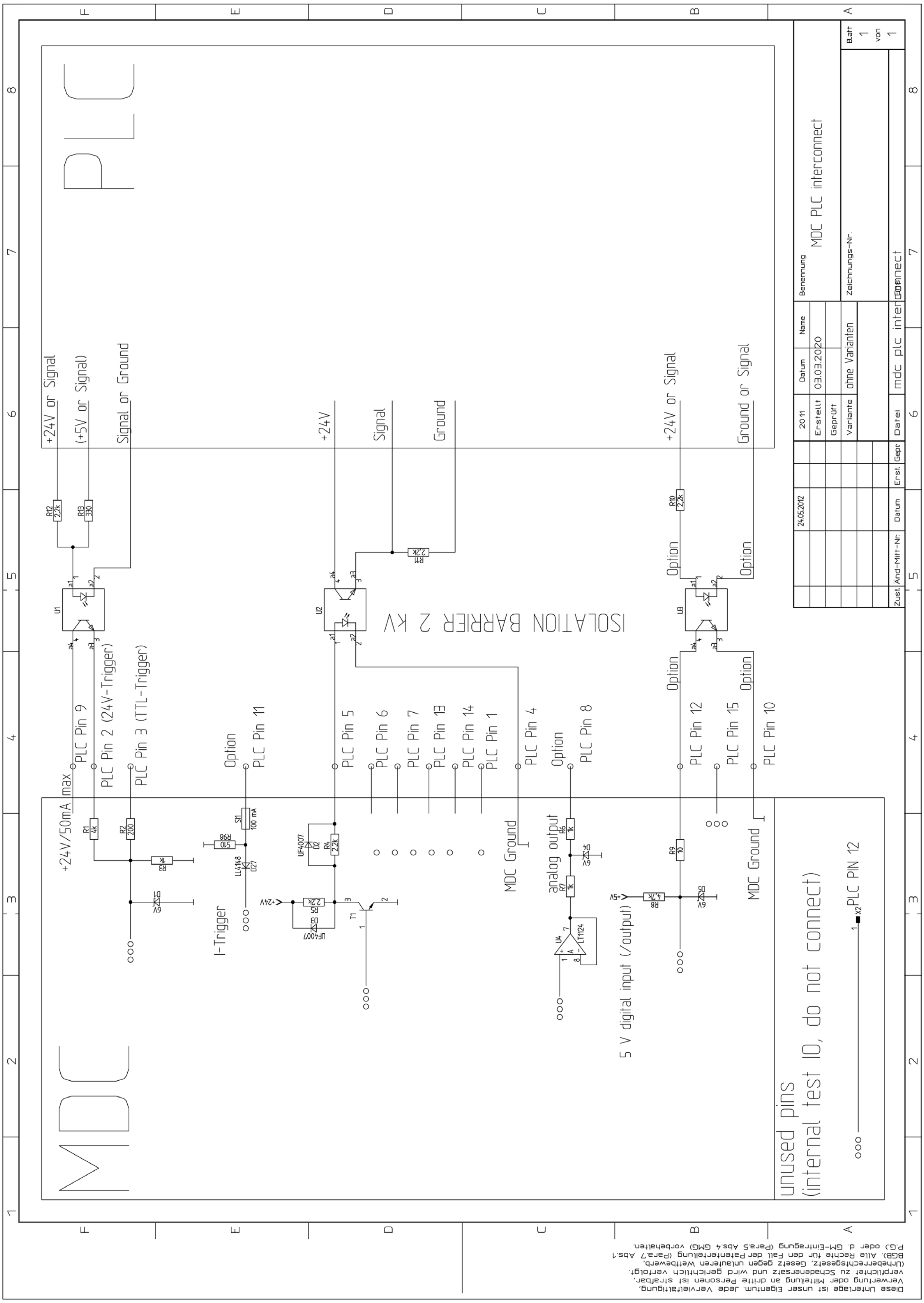
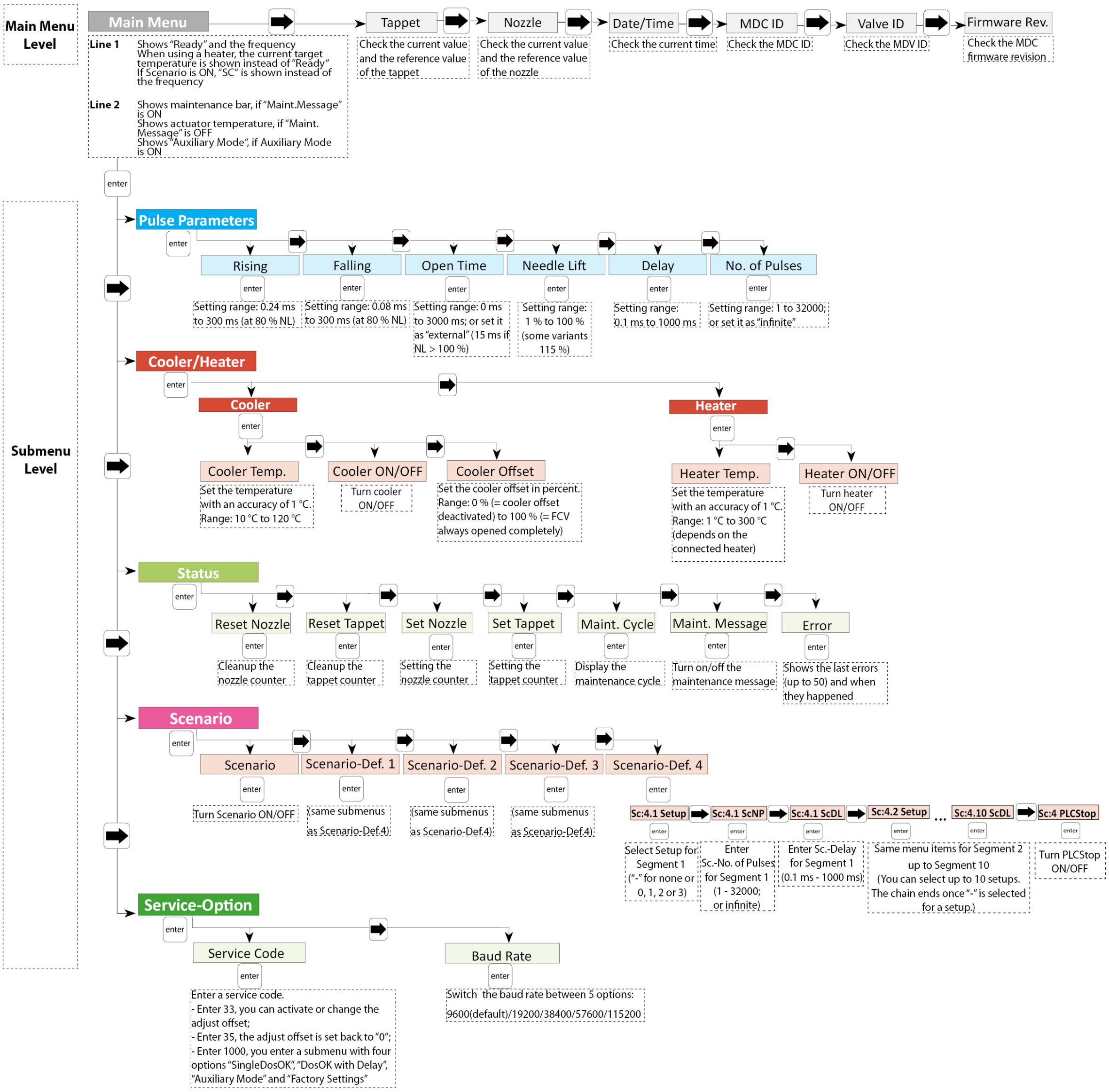


Fig. 82: Connection Diagram PLC-interface

14.5 Overview of the MDC Menu

For a more detailed description of the menus and submenus, see paragraph 4.5, page 27.



Line 1 Shows “Ready” and the frequency
When using a heater, the current target temperature is shown instead of “Ready”
If Scenario is ON, “SC” is shown instead of the frequency

Line 2 Shows maintenance bar, if “Maint.Message” is ON
Shows actuator temperature, if “Maint. Message” is OFF
Shows “Auxiliary Mode”, if Auxiliary Mode is ON

Check the current value and the reference value of the tappet

Check the current value and the reference value of the nozzle

Check the current time

Check the MDC ID

Check the MDV ID

Check the MDC firmware revision

Setting range: 0.24 ms to 300 ms (at 80 % NL)

Setting range: 0.08 ms to 300 ms (at 80 % NL)

Setting range: 0 ms to 3000 ms; or set it as “external” (15 ms if NL > 100 %)

Setting range: 1 % to 100 % (some variants 115 %)

Setting range: 0.1 ms to 1000 ms

Setting range: 1 to 32000; or set it as “infinite”

Set the temperature with an accuracy of 1 °C. Range: 10 °C to 120 °C

Turn cooler ON/OFF

Set the cooler offset in percent. Range: 0 % (= cooler offset deactivated) to 100 % (= FCV always opened completely)

Set the temperature with an accuracy of 1 °C. Range: 1 °C to 300 °C (depends on the connected heater)

Turn heater ON/OFF

Cleanup the nozzle counter

Cleanup the tappet counter

Setting the nozzle counter

Setting the tappet counter

Display the maintenance cycle

Turn on/off the maintenance message

Shows the last errors (up to 50) and when they happened

Turn Scenario ON/OFF

(same submenus as Scenario-Def.4)

(same submenus as Scenario-Def.4)

(same submenus as Scenario-Def.4)

Select Setup for Segment 1 (“-” for none or 0, 1, 2 or 3)

Enter Sc.-No. of Pulses for Segment 1 (1 - 32000; or infinite)

Enter Sc.-Delay for Segment 1 (0.1 ms - 1000 ms)

Same menu items for Segment 2 up to Segment 10 (You can select up to 10 setups. The chain ends once “-” is selected for a setup.)

Turn PLCStop ON/OFF

Enter a service code.
- Enter 33, you can activate or change the adjust offset;
- Enter 35, the adjust offset is set back to “0“;
- Enter 1000, you enter a submenu with four options “SingleDosOK”, “DosOK with Delay”, “Auxiliary Mode” and “Factory Settings”

Switch the baud rate between 5 options: 9600(default)/19200/38400/57600/115200

Information
- Press **[enter]**-key or [↓]-key in the main menu level, you enter the submenu level that starts with the submenu “Pulse Parameters“.
- Press **[enter]**-key or [↓]-key in any submenu, you reach the submenu items.
- At each submenu item, press [**enter**]-key or [↓]-key to reach the page where you can change the settings.
  Use arrow keys to change the value or switch between optional settings.
  Confirm the change with **[enter]**-key. Quit the change with **[esc]**-key (MDC returns to the respective menu item).
- Press [**esc**]-key in any submenu item, MDC returns to the next higher menu for appox. 1 sec, then directly jumps back to the main menu.
  Press [↑]-key in any submenu item, MDC returns to the next higher menu.
- If you do not press any button for longer than 10 sec, the dispay jumps automatically back to the main menu.
- With [→]-key or [←]-key, you can switch around the items in any menu level.
  Menus are always “wrap-around”, i.e. you can move on from the last item in a menu directly on to the first.
- Texts in dashed frames are not displayed.

Fig. 83: Overview of the MDC Menu

14.6 Overview of the Command Functions

Details of the commands listed below are explained in paragraph 8.1.2.3, page 95.

	RS-232C commands	Functions
1	*ESR? (e.g. 50 errors)	Check the latest error codes
2	*ESR2? (e.g. 50 errors)	Check the latest error codes with parameters
3	*IDN?	Check device information
4	*OPC?	Check the last trigger impulses
5	ADJUST:?	Check the adjust status
6	ADJUST:START	Initiate the adjust
7	ADJUST:OFFSET:?	Check current adjust offset value
8	ADJUST:OFFSET:<offset value>	Set adjust offset value
9	ADJUST:CALIBRATION:?	Check the status of (remote) adjust
10	ADJUST: CALIBRATION:ON	Activate the adjust
11	HEATER:?	Check the heater status
12	HEATER:ID?	Check the information of the connected heater
13	HEATER:OFF	Turn off the connected heater
14	HEATER:ON	Turn on the connected heater
15	HEATER:TEMP:<target temperature>	Set the target temperature for the connected heater
16	HEATER:LIMITS:<min>,<max>	Set the limits for the temperature regulation
17	COOLER:?	Check the cooling status
18	COOLER:ID?	Check the information of the connected flow control valve
19	COOLER:OFF	Turn off the connected flow control valve
20	COOLER:ON	Turn on the connected flow control valve
21	COOLER:TEMP:<target temperature>	Set the target temperature for the cooling
22	COOLER:OFFSET:<offset>	Set the cooler offset for the connected flow control valve
23	KEY:ENTER	Send ENTER signal to confirm error(s)
24	KEY:ESCAPE	Send ESCAPE signal
25	HELP	Check all RS-232C commands
26	LCD?	Check current content of the screen
27	MAINT:STATUS	Check accumulated amount of pulses (in %)
28	MAINT:MESSAGE:OFF	Deactivate the maintenance message
29	MAINT:MESSAGE:ON	Activate the maintenance message
30	SYSTEM:KLOCK:OFF	Unlock the keypad
31	SYSTEM:KLOCK:ON	Lock the keypad
32	SYSTEM:SHOW:CYCLES	Check the current cycle counter
33	SYSTEM:SHOW:VALVEID	Check the valve ID
34	SYSTEM:SHOW:CONTROLLERID	Check the MDC ID
35	SYSTEM:SHOW:STATUS	Check the status of KeyLock, DosOK with Delay, SingleDosOK, Auxiliary Mode and Multi Dot Mode
36	SYSTEM:SHOW:ACTTEMP	Check the actuator temperature
37	SYSTEM:DOSOKDELAY:OFF	Deactivate the DOSOK-Delay

	RS-232C commands	Functions
38	SYSTEM:DOSOKDELAY:ON	Activate the DOSOK-Delay
39	SYSTEM:SINGLEDOSOK:SETUP	Set the Single-DOSOK signal to “Setup”
40	SYSTEM:SINGLEDOSOK:PULSE	Set the Single-DOSOK signal to “Pulse”
41	SYSTEM:PASSWORD:<your password>	Send the password for unlocking the keypad
42	SYSTEM:PASSWORD:OFF	Deactivate the password for unlocking the keypad
43	SYSTEM:PASSWORD:ON	Activate the password for unlocking the keypad
44	SYSTEM:PASSWORD:SET:<your password>	Set the password for unlocking the keypad
45	SYSTEM:AUXILIARYMODE:OFF	Deactivate the auxiliary mode
46	SYSTEM:AUXILIARYMODE:ON	Activate the auxiliary mode
47	SYSTEM:MULTIDOT:OFF	Deactivate the multi dot mode
48	SYSTEM:MULTIDOT:ON	Activate the multi dot mode
49	TRIGGER:SET:?	Check the pulse parameters in the RAM
50	TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM (“Rising”: 1/10 ms) (MDC returns “OK”)
51	TRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM (“Rising”: 1/10 ms) (MDC returns “OK”)
52	TRIGGER:ASET:?	Check the pulse parameters in the RAM
53	TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM (“Rising”: 1/100 ms) (MDC returns “OK”)
54	TRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM (“Rising”: 1/100 ms) (MDC returns “OK”)
55	STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM (“Rising”: 1/10 ms) (MDC returns the saved parameters)
56	STRIGGER:SET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM (“Rising”: 1/10 ms) (MDC returns the saved parameters)
57	STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Change the pulse parameters in the RAM (“Rising”: 1/100 ms) (MDC returns the saved parameters)
58	STRIGGER:ASET:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>,1	Change the pulse parameters in the EEPROM (“Rising”: 1/100 ms) (MDC returns the saved parameters)
59	VALVE:UP	Open the valve
60	VALVE:DOWN	Close the valve
61	VALVE:AOPEN	Initiate a dispensing cycle with current parameters (MDC returns “OK”)
62	VALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters (MDC returns “OK”)
63	VALVE:AOPENS<setup no.>	Initiate a dispensing cycle with selected setup (MDC returns “OK”)
64	SVALVE:AOPEN	Initiate a dispensing cycle with current parameters (MDC returns the saved parameters)
65	SVALVE:AOPEN:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Initiate a dispensing cycle with given parameters (MDC returns the saved parameters)
66	SVALVE:AOPENS<setup no.>	Initiate a dispensing cycle with selected setup (MDC returns the saved parameters)

	RS-232C commands	Functions
67	WRITE:LCD:<text>	Write an ASCII text on the display
68	TAPPET:SET:<value>	Set tappet maintenance counter
69	TAPPET:CLEAR	Clear tappet maintenance counter
70	NOZZLE:SET:<value>	Set nozzle maintenance counter
71	NOZZLE:CLEAR	Clear nozzle maintenance counter
72	SCENARIO:STATUS	Check the status of scenarios and PLCstops
73	SCENARIO:OFF	Deactivate the use of scenarios
74	SCENARIO:ON	Activate the use of scenarios
75	SCENARIO:PLCSTOP:1:OFF	Deactivate the PLC-Stop
76	SCENARIO:PLCSTOP:1:ON	Activate the PLC-Stop
77	SCENARIO:SAVE:<scenario no.>:<values>	Save the parameters for selected scenario
78	SCENARIO:READ:<scenario no.>	Check the parameters of selected scenario
79	SETUP:ASAVE:<setup no.>:<RI>,<OT>,<FA>,<NL>,<NP>,<DL>	Save parameters in a setup
80	SETUP:AREAD:<setup no.>	Check the parameters of a setup
81	BAUDRATE:0/1/2/3/4	Change the baud rate
82	GETTD	Check the current time
83	MDC:RESTART	Restart the MDC

14.7 Connection Diagram MDS 358x

This diagram shows the connections of an MDS 3581-V.

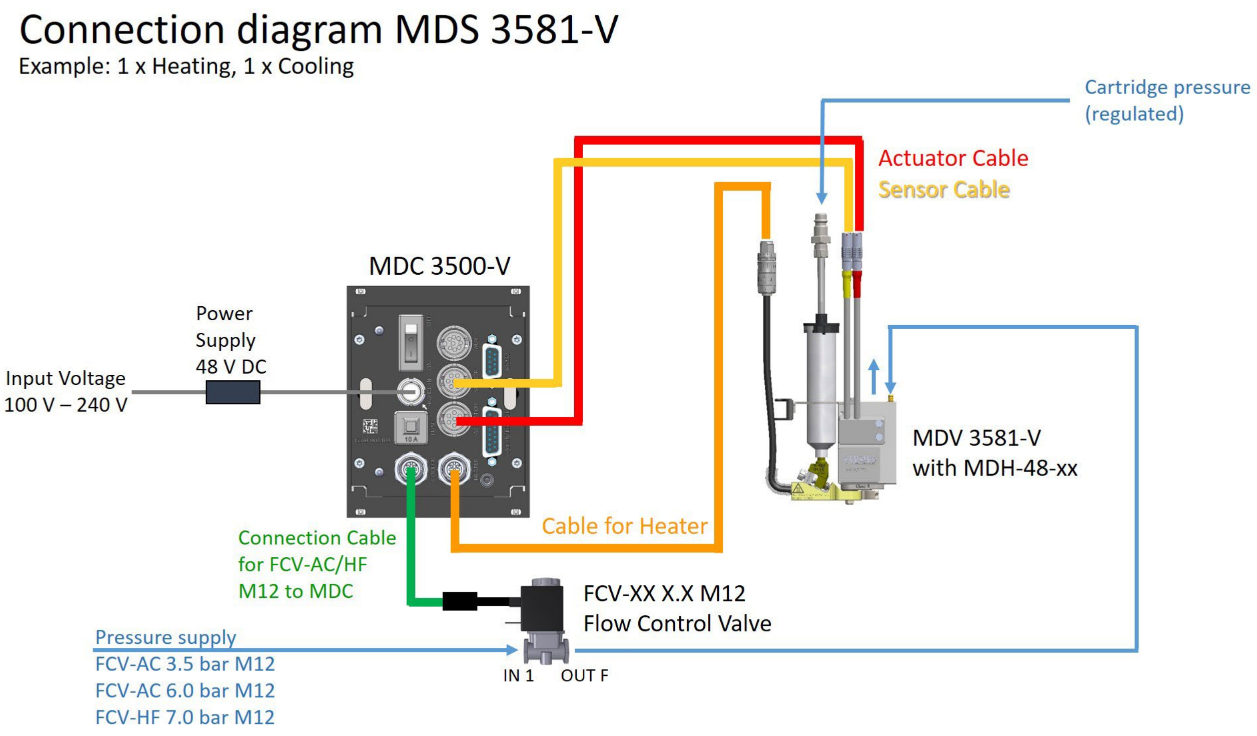


Fig. 84: Connection Diagram MDS 3581-V

14.8 Declaration Concerning Decontamination of Shipped Equipment

Before returning Microdispensing Systems for purposes of inspection, maintenance and repair, be sure that the equipment is in a completely decontaminated state. You have to fill out the following form correctly; otherwise, the order will not be processed. Upon request, VERMES Microdispensing performs the required decontamination after receipt of the corresponding safety data sheet. This work will be calculated separately.

Only authorized and responsible personnel may fill out and sign this declaration!

1 Designation of the System	
Serial No.:	MDV SN# ________________________________
	MDV SN# ________________________________

2 Legally Binding Declaration	
The signer declares that the microdispensing system is free of any substances harmful to health. The decontaminated system is shipped according to legal prescriptions.	
Company: ________________________________	
Address: ________________________________ ________________________________	
Name: ________________________________	
Phone: ________________________	Fax:________________________
E-Mail: ________________________________	
Date: ________________________	Signature: ________________________
Company Stamp:	

3 Note for Shipment
In order to prevent damage to the equipment, the manufacturer recommends using the original packaging material for return. Instructions about transport have to be observed (see paragraph 12.1, page 172). The manufacturer is not liable for any damage resulting from inadequate packaging or transport.

15 List of Figures

16 List of tables

17 Index